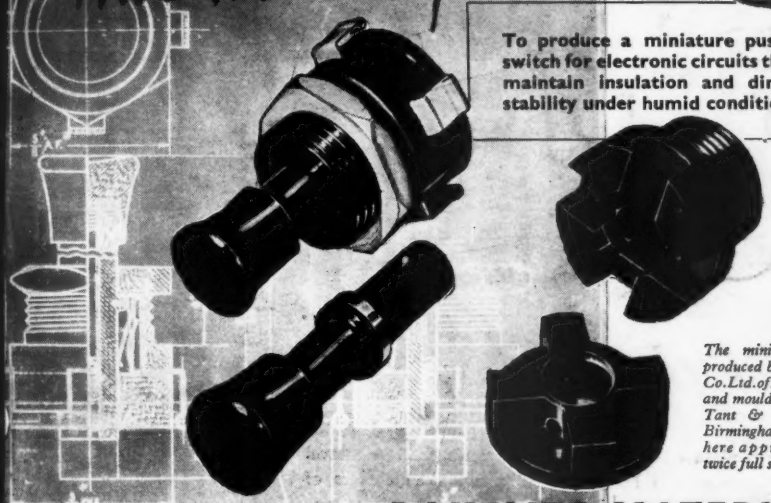
Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

This was the problem DETROIT

To produce a miniature push button switch for electronic circuits that would maintain insulation and dimensional stability under humid conditions.



The miniature switch produced by Painton & Co. Ltd. of Northampton and moulded by W. H. Tant & Co. Ltd. of Birmingham is shown here approximately twice full size.

—solved by using BAKELITE MATERIAL

Two problems were presented by the humid conditions under which the miniature switch produced by Painton & Co. Ltd., Northampton, was required to work. With a leakage path of only 0.137-in. between contacts electrical insulation had to be maintained at a high level. At the same time no swelling was tolerable on the moulded switch spindle. Both these exacting requirements were met by a special grade of nylon-filled BAKELITE material X.11072 (Patented). Following two humidity cycles, the insulation resistance of the switches tested was in all cases greater than 105 megohms after 24 hours recovery. Samples further withstood a life test of 10,000 operations with 50 milliamps at 300 volts A.C. between adjacent poles.

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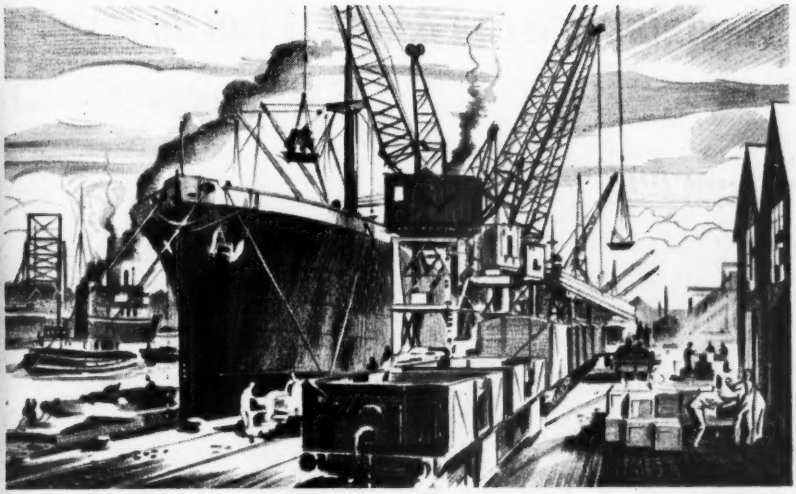

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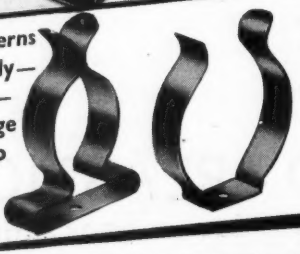

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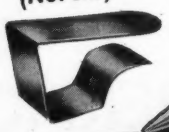

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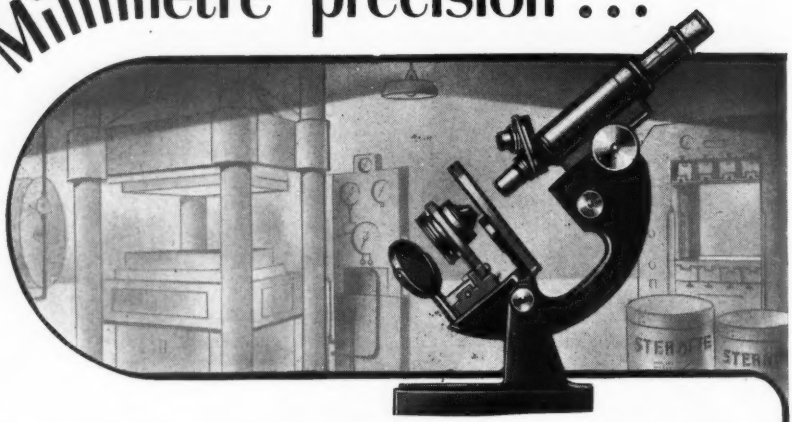

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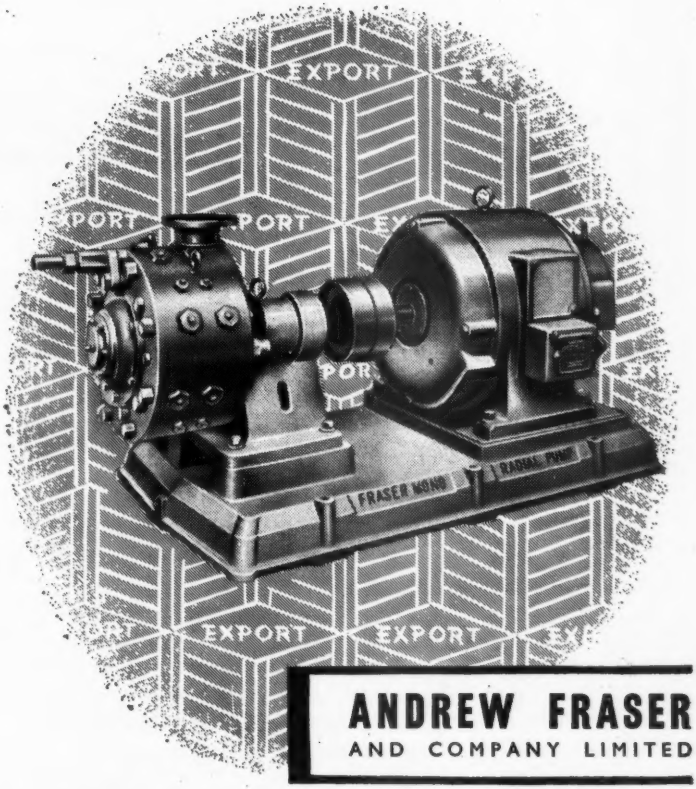

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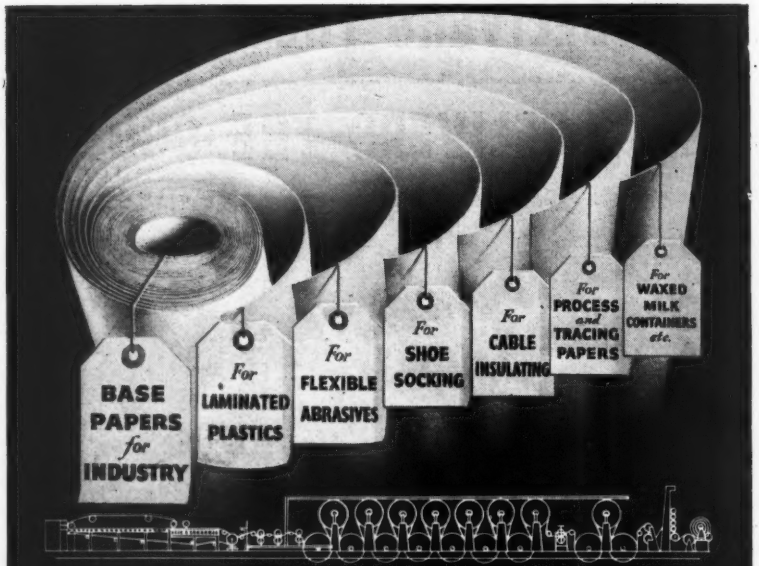

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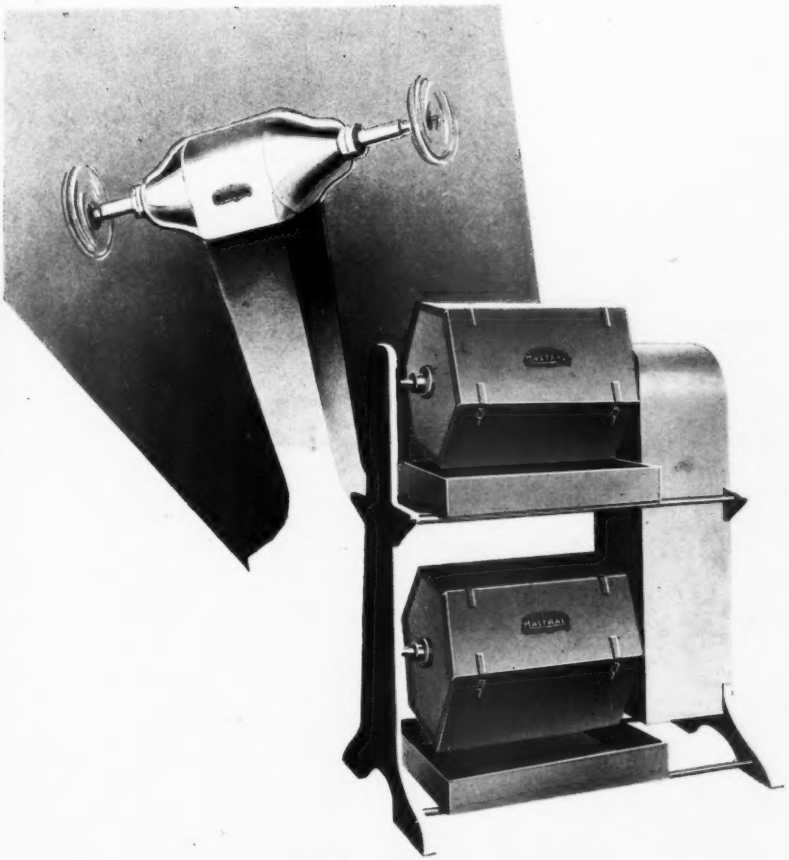

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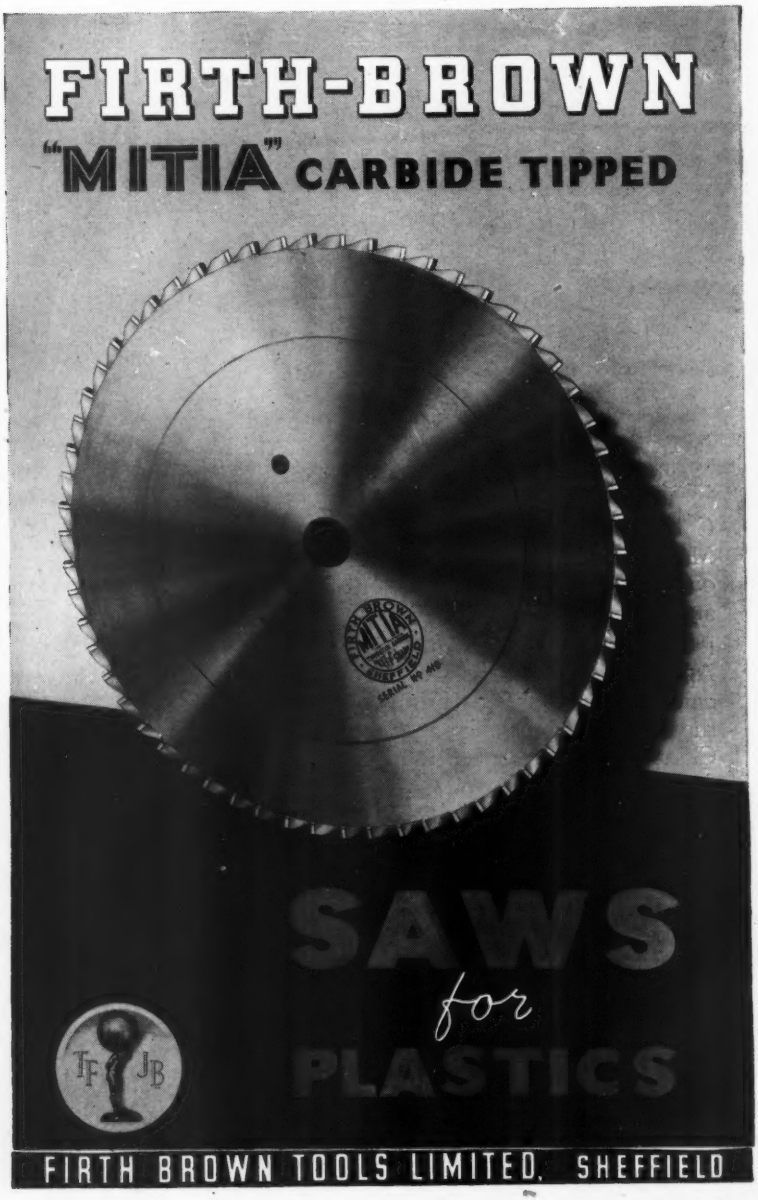
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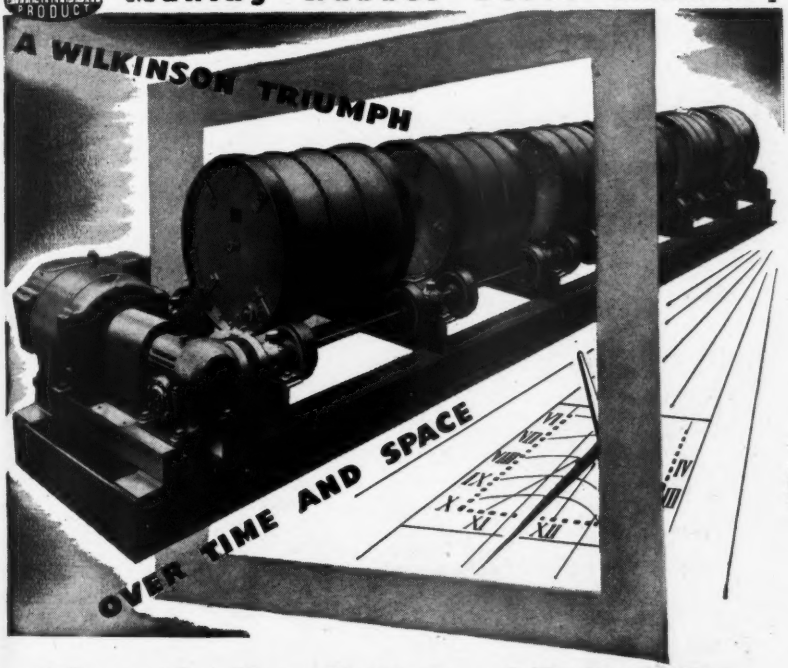

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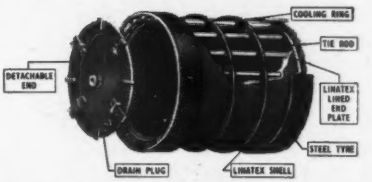

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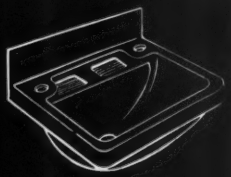

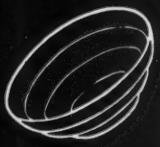

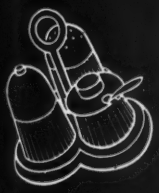

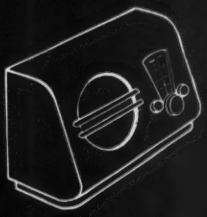

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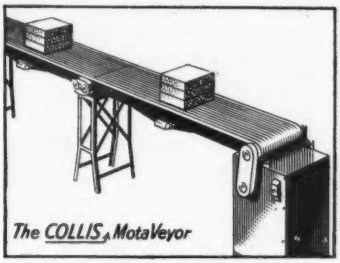

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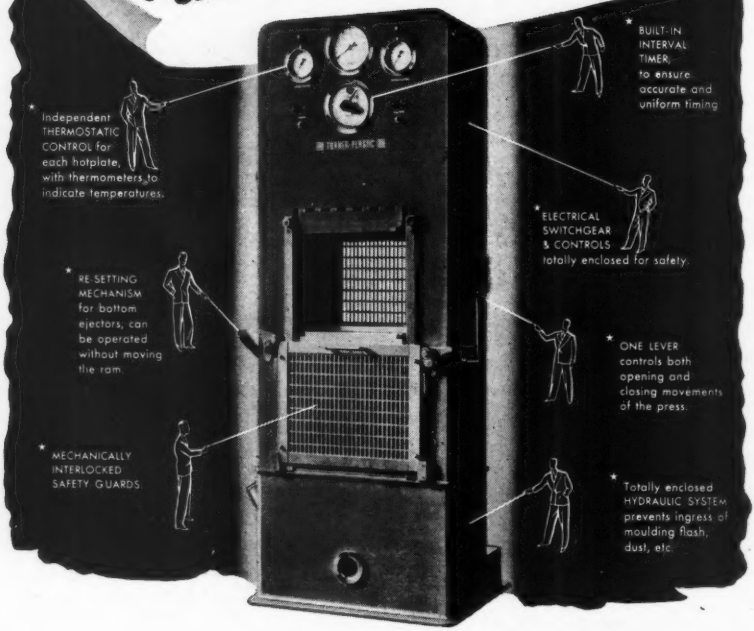
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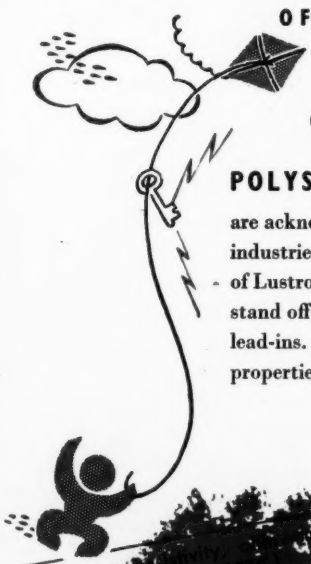

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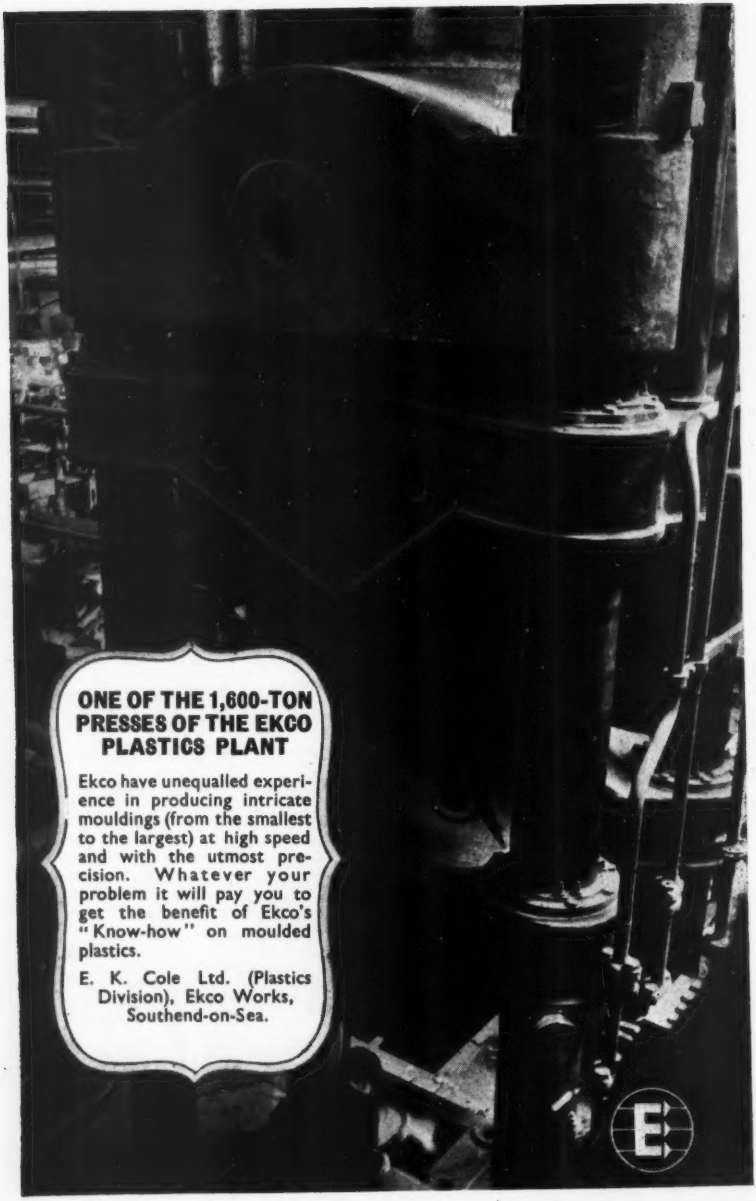
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I don't think you can do it, he said, which of course is a sure way of starting something at Ashdowns. Our customer was talking about his radio cabinet. It was a single moulded two-colour job. The fret was to be sprayed cream and it would have to be good. It would have to face a mighty tough test.

I only know one man who could do that job, our customer said, but he's not in the country. That clinched it. We got to work. Our first go was a flop and our faces were red but we set to work again. Success.

Okay, our customer said, you win, and as a reward for enterprise I'll tell you this is a better job than the fellow who's not in this country would have done.

If you want to know about plastics ask **Ashdowns**

In addition to making mouldings, we have a special department for fabricating "PERSPEX", and we make "ASHLAM" electrical insulation boards, which, incidentally, are exceedingly good.

'ASHLAM' is the registered trade mark of Ashdowns Ltd. 'PERSPEX' is the registered trade mark of I.C.I. Ltd.

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Ashdowns is a subsidiary of Pilkington Brothers Ltd.

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BRUSH HANDLES **TERMINAL BLOCKS**

VACUUM CLEANER PARTS

ELECTRICAL FITTING PARTS

TELEPHONE PARTS **etc. etc.**

All the above and a multitude of other parts are produced by the compression transfer and injection moulding processes in thermosetting and thermoplastic materials and Crystalate special materials.

CRYSTALATE

Crystalate Ltd., Golden Green, Tonbridge, Kent. *Phone: Hadlow 233/4/5 (20 lines)*

Established 48 years

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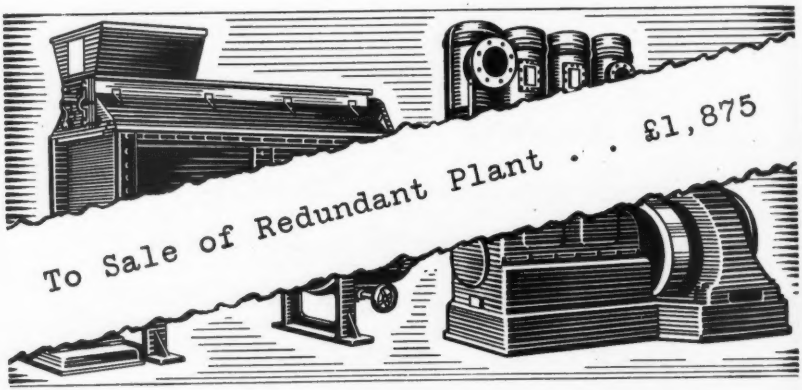

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481/P26

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TECHNICAL PLASTICS

RODS
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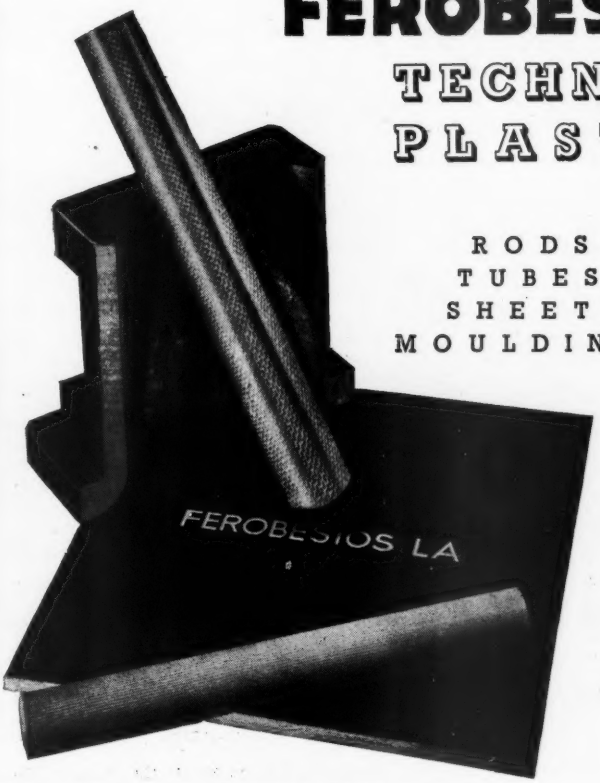
SHEETS
MOULDINGS



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If you require

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FERODO LIMITED · CHAPEL-EN-LE-FRITH
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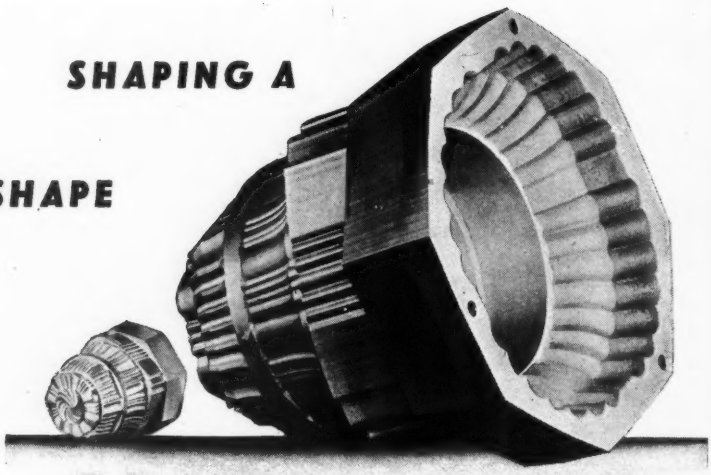
REG'D TRADE MARK FERODO

SHAPING A SHAPE



We don't expect anyone to ask us for a mould of the shape shown here, but we do expect, and get, and carry out orders for tools quite as intricate in design. This demonstrates what can be accomplished with a shape lathe . . . you see it just as it left the lathe, before finishing. We did not invent the shape lathe on which this was turned, but we have added to it refinements you will not meet elsewhere. Some of our other machines we have created, because nothing existed to do the job, and this has helped to make us the most highly specialised and self-contained plastic mould-making unit in the industry. We leave nothing to chance. No phase of the work suffers from improvisation. Everything is meticulously tested and inspected at every stage. Our expert after-sales advisory service provides technical assistance for the moulder and ensures a long life and satisfactory performance for all our products.

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Telephone: Birmingham East 2061 Telegrams: Plasmould Birmingham 24

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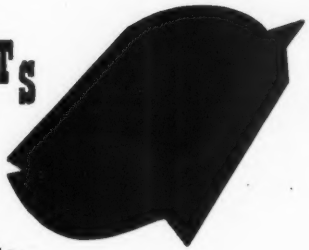

ARE ALL TO OUR TASTE

Perhaps fish-faced plastic sections mean nothing to you. But something just as out-of-the-ordinary might 'put paid' to *your* particular production snag.

You may not have to look beyond the standard Tenaplas ranges (applications: from trimmings to television; lamp-shades to giant liners). But should you conceive some undreamed-of use for Tenaplas, our resources and experience are at your call. Shape, colour, length, size (down to the finest limits), as you wish.

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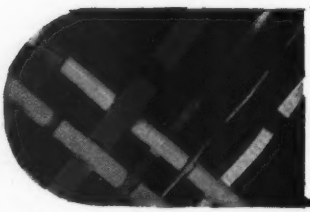
★ *All types of industries are using Tenaplas to-day — often in rather unexpected ways. For instance, new uses found for Tenaplas include: dividing wires in the IMHOF gramophone record holder, spray reduction in electro-plating bath, covering storm rails on the "Queen Mary". Tenaplas is also used extensively in the new Percival Prentice aircraft.*



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THE NAME TO REMEMBER FOR **FLEXIBLE** (AND RIGID) **PLASTICS**
IN ANY CONTINUOUS LENGTH, SHAPE OR COLOUR

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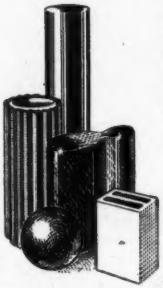
T.P.14A



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Whatever the shape, whatever the design, you name it, we'll make it . . . in Catalin Cast Resin. From start to finish within *one* organisation. No outside costs . . . no expensive master tools . . . plus the following positive advantages:

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A well-built condensate return system,

but only the fish got the benefit!

The management of a certain works went to great trouble to install a condensate return system, but were discouraged to find that they were still getting cold water to feed their boilers. The Ministry's Fuel Engineer, who happened to hear of their difficulty, discovered that the return main passed through a river on its way back to the boiler house. The result was a fine central heating plant for the local fish and an equally effective cooling system for the condensate which they had taken such care to collect.

This wouldn't happen to you!

Of *course* not. But it did happen to someone! And this is no isolated instance of the obvious being overlooked. We all have our blind spots, and however familiar we are with an installation or a process, we are liable to pass over bad or out-dated practices that a fresh pair of eyes would spot in a moment.

Wouldn't you be wise to ask the Ministry's Fuel Engineer to pay you a visit—just in case? Not only is he rich in practical experience, but he can look at the job from a fresh point of view.

By the way, have you referred to "The Efficient Use of Steam" by Oliver Lyle? It can be ordered through any bookseller (886 pp., 15/- net), or obtained from H.M. Stationery Office, 15/9 post free.

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Eastern	Shaftesbury Road, Brooklands Avenue, Cambridge	Cambridge 56268
London	Mill House, 87/89, Shaftesbury Avenue, W.1	Gerrard 9700
South-Eastern	95, High Street, Rochester	Chatham 3487
Southern	Whiteknights, Earley, Reading	Reading 61491
Wales	27, Newport Road, Cardiff	Cardiff 9234
South-Western	12/14, Apsley Road, Clifton, Bristol, 8	Bristol 38221
Midland	Temporary Office Buildings, Hagley Road West, Birmingham. 17	Bearwood 3071
North-Western	Burton Road, West Didsbury, Manchester, 20	Didsbury 5180-4
Scotland	145, St. Vincent Street, Glasgow, C.2	Glasgow City 7636
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Sole Manufacturers
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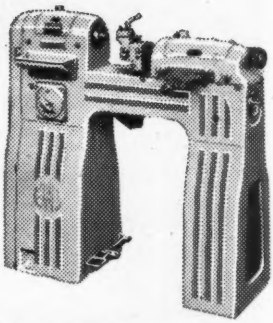
A LATHE FOR THE PLASTIC INDUSTRY

Improved production now allows immediate delivery of the new "Anglon" Lathe specially built for plastic turning and button making. This fast, accurate machine is motorised and extremely compact. May we supply full data?



The British

ANGLON

Plastic Turning Lathe . . .

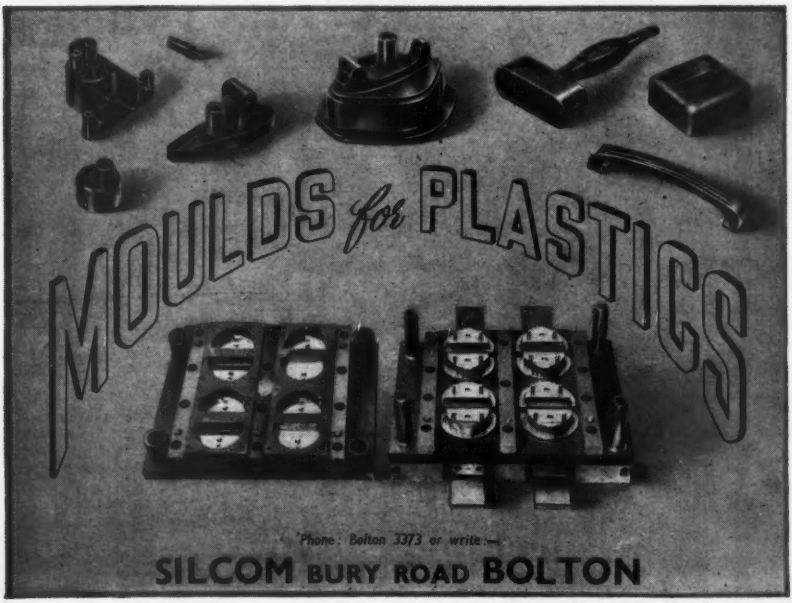
Built by THE EAST ANGLIAN ENGINEERING CO. OF LOWESTOFT FOR

Our Button Manufacturers' Service is being rapidly augmented by the addition of new lines; several interesting machines will be announced shortly. Contact our Button Plant Division for full details of the E. H. J. Service.

E. H. Jones (MACHINE TOOLS) LTD

Colindale 7011 Grams: Tools, Kilburn, London

EDGWARE ROAD • THE HYDE • LONDON • N.W.9



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SILCOM BURY ROAD BOLTON

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Fothergill & Harvey *introduce*

Tygan

a new woven upholstery fabric

TOUGH · WASHABLE · HYGIENIC
MOTHPROOF · FAST TO LIGHT

Tygan is a new synthetic upholstery fabric woven exclusively by Fothergill & Harvey Ltd., the old-established Lancashire textile manufacturers. It is made from Bexan, a synthetic yarn developed after years of intensive research by B.X. Plastics Ltd.

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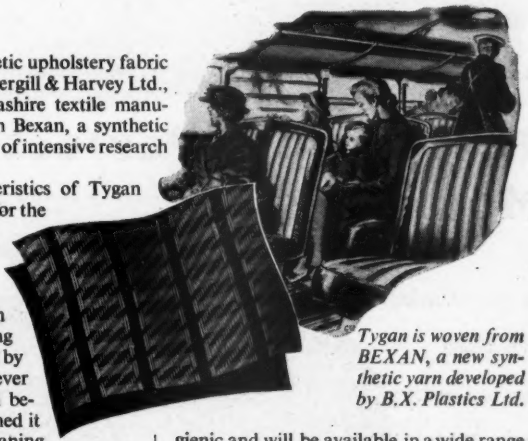

Tygan is woven from BEXAN, a new synthetic yarn developed by B.X. Plastics Ltd.

Tygan undergoes the same rigorous testing as other Tyga Textiles in the laboratories of Fothergill & Harvey Ltd. This is an assurance of the consistent high quality and serviceability of Tygan, which conforms in every respect to the highest standards of Lancashire woven productions.

● This is one of the advertisements for Tygan appearing in the Transport Trade Press.

Write for illustrated folder with patterns, quoting reference Z2, to FOTHERGILL & HARVEY LTD., Thirty-seven Peter Street, Manchester 2

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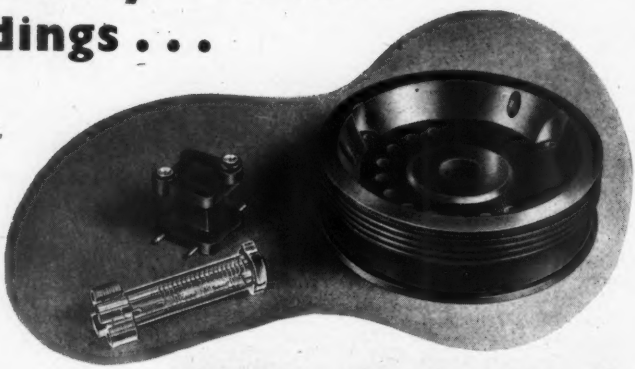
for the – Aircraft, Engineering, Electrical and Fancy Goods Trades



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. . . and has excellent electrical characteristics, too! No other insulation material offers such an outstanding *combination*★ of desirable properties. Full technical information is available on request.

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TEMPERATURE CONTROL

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THIS CAMBRIDGE THERMOMETER REGULATOR is specifically designed for plastics moulding presses, and is standardised equipment on many well-known makes.

SPECIFICATION :
Range : 250°—400° F.
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WORKS: LONDON & CAMBRIDGE

Details are given in SHEET No. 276-P. May we send a copy?

Vol. XII. No. 133 JUNE, 1948

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

Proprietors - - TEMPLE PRESS LIMITED
Chairman and Managing Director ROLAND E. DANGERFIELD

Editor - - M. D. CURWEN, B.Sc., A.R.I.C.
Offices - Bowling Green Lane, London, E.C.1

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Head Offices:
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Telephone - *Glasgow Central* 9036.

EDITORIALS

Trade and the Fair

THERE is no doubt whatever in our minds that the Plastics Section at the B.I.F. was the best we have yet seen in all the years we have attended it. Individually, with few exceptions, the stands were superbly arranged. Collectively, they formed a shining mirror of the new trends of a virile industry.

And yet the results were by no means so good as we had all hoped. It is true that at some of the stands the queues of visitors and buyers seemed never to grow shorter, but, on closer examination, it appeared that these offered something in the way of a new process or a new production, which attracted industries that could use them. At these stands business was fantastically excellent. Mostly it was good but sometimes disappointing.

It is too early to make a detailed analysis, but, on the whole, we can divide the trouble into weakness in the buying at home because of a decrease in the spending capacity or even willingness to spend, and to such things as the restrictions in the building industry, which absorbs so much of plastics. Furthermore, foreign buying is contracting gradually, especially for finished goods. It is most difficult for foreign buyers to obtain import licences for anything but raw materials. This is not only due to the financial situation of most countries, but also due to the desire by all foreign countries to manufacture plastics goods. Hence, raw materials and machinery imports are often permissible where finished goods are not.

Certainly most of the inquiries we received at the exhibition and for several years past at the offices of this journal, are more generally for raw materials, that is moulding powders in all their forms and, especially, moulding presses.

It is obvious, we think, we must all face the fact that, since the industrial revolution of the 19th century, all countries at some stage in their career show an overwhelming desire to make finished goods themselves. Generally, in the plastics industry, this begins with the manufacture of small fancy goods. How far it does eventually go depends on the level of technical education.

It is very easy to make plastic goods badly. It is very difficult to make them well, and very, very difficult to make them superbly.

Therein lies our future. We must maintain our high standards and even keep on raising them.

Cups and Saucers

AS we have been close observers of the plastic world for nearly a quarter of a century, we may appropriately report on one section of it that has surpassed our own hopes and beliefs.

It is about 25 years ago that the first moulded cup and saucer appeared on the market. Although our memory is weak on the point, we seem to remember that they were of phenolic resins at first and mainly ran in colour to a mottle which moulders, quite rightly, believed would arouse a new emotion in an unsuspecting public. The emotion roused in the breast of the average observer did not, however, induce him or her to buy the monstrosities, and mottle as an essay in æsthetics or as a cheap dodge to use up odd residues of moulding powders has now almost, although not entirely, disappeared. Thus, we educate ourselves by experience.

When the urea resins appeared the real attempt to produce presentable cups and saucers began. It began, in fact, with a considerable and deserved success, for some few moulders concentrated on one branch of the " china " industry, namely, that of picnic sets. It also realized, since

the "china" industry had gone on for a thousand years and more, that it had a tradition in which the simple single colours predominated and that it was worth while copying it.

So successful were they, indeed, that the vast majority of cups and saucers in picnic sets in existence are of plastics. They are light in weight, which is of paramount importance, and breakage is negligible.

To-day we have expanded our raw materials for the purpose and we see a growing use for them. We now have, to a limited extent, the melamine resins, which are in many ways better for the purpose than the urea. Furthermore, within the past four or five years we have seen the acrylic resins, the polystyrene resins and, finally, polythene applied for the same production, and because of these latter we may yet see an important encroachment on other branches of the trade in "china."

For children and babes we believe the polythene type superb. It is virtually (meaning truthfully!) unbreakable, being tough and flexible enough to withstand a hammer blow. We have also been told, by a housewife, that it is the first she has used which "tastes like china"! The only drawback is, strangely enough, extreme lightness.

The acrylic and polystyrene cups and saucers are also advancing in stature rapidly. So great is the improvement in design, in production, in choice of delicate colours, pale blue, pale yellow, off-white and very pale rose, that the housewives are at last sitting up and taking notice. At a period when they can only buy very inferior quality "seconds" and probably "throw-outs" in china at high prices, this is a time to strike very hard and to give them of the best the plastics industry can make. We believe that so "unbreakable" are they in comparison with the conventional type, that we shall, in future, supply some percentage to all homes for normal and not merely special purposes.

Here again lightness is a drawback at first. Waitresses in restaurants will find them different, but will probably become accustomed to them, and lighter-handed. At least we hope so, for it would not be easy to weight both cup and saucer.

At any rate, we think that now, after some ten years of comparative stagnation, there is a good chance of entering seriously into one of the largest demands in the world.

Tale of a Tile

IF we may be slightly historical again, the first moulded wall tile we saw, in or about 1937, was moulded in urea resin, and had queer attachments presumably for nailing against walls.

We do not believe they saw the light of industrial day, perhaps because of the aforesaid attachments and the curious idea of nailing tiles on walls, or perhaps because urea resins were not suitable enough. The next stage in the development was that in the U.S.A., when, in early 1941, Recto Moulding Products Inc., of Cincinnati, using Mosanto's Lustron (polystyrene), produced 5 in. by 5 in. tiles in the form of shallow boxes which were clipped together and mounted on a frame, which formed the wall. So far, no attempt had been made to consider a tile that could be cemented on a concrete or other type of wall, and since, in the above instance, there would have been some leakage between the tiles of moisture, it is difficult to imagine that they would have appealed immediately to builders. However, as a decorative wall for business buildings, hotels and the like, the idea seemed very attractive. Whether or not this tile is still in existence we do not know, but there is at least one form on the U.S.A. market.

On another page we have noted the appearance of British tiles, both made from polystyrene and both utilizing a cement for fixing them against walls. Each is about 6 in. by 6 in. and weighs about 1½ ozs.

Obviously, we think polystyrene the best synthetic resin for the job to date. Light and attractive in appearance, the tiles do not break on dropping on wood or linoleum-covered floors. They are

also impervious to moisture and can readily be stuck to concrete or wood. On the whole, we consider the cement, in a sense, more important than the tile itself, for so much depends on the adhesive. Theoretically, we believe it should be that very rare type, permanently plastic in the cold, that is non-hardening with age.

There is really no good reason why plastic tiles should not replace the porcelain variety, which are not only expensive but are liable to break or split on the wall, and are extremely heavy. In the U.S.A. one of the most important of sales points is this last fact, and in a very tall building the saving in weight can be enormous, for while a plastic tile weighs only 1½ oz., a porcelain one is about 1 lb. 5 oz. in weight, to say nothing of the weight of the cement needed to stick it on the wall. The plastic tile, in fact, could save on the main construction costs and transport.

Bottle Stoppers

THE problem of stopping bottles efficiently has always been a big problem for the pharmaceutical industry and for those manufacturers who have to sell and transport delicate products such as the vitamins and other biological compounds, volatile organic compounds or the very expensive essential oils which make the basis of perfumes and deodorants generally. Ordinary corks may not only affect the quality of the contents, because of colour or the resinous compounds that are sometimes in the corks themselves, but imperfect corks may admit air to spoil the contents or permit of leakage outwards. The ground glass stopper, while apparently "perfect" from the point of view of not affecting the contents chemically, is sometimes very imperfect and can, in fact, prove deleterious to very sensitive products of the biological type. Furthermore, breakage is almost irreplaceable by the customer and "sticking" can prove a definite danger.

It is, therefore, with pleasure that on page 298 we publish Mr. Pickering's notes on the production of new ranges of stoppers, more especially of the polythene type, since he has, for many years, been engaged on the scientific side of pharmacological production and knows the importance of the subject under review.

Obviously similar stoppers are of immense importance in the chemical world, especially in the laboratory where acid and other chemical reagent bottles are essential and also, to a limited extent, for the transport of similar chemicals in Winchester quart bottles.

We wonder whether the use of such excellent stoppers can be extended further? Obviously the small glass scent bottles can be so protected and colourfully improved, but we are thinking more of replacement of the ubiquitous cork which stops our bottles of commerce, so many of which contain costly and nourishing liquid foods.

The trouble about whisky and beer bottles is not perhaps the effect of the cork on the contents of the container, although passage of air inwards is one of the reasons of "haze." We believe that there is no such thing as bad whisky or bad beer, as turned out by reputable distillers and brewers. Rather is it the fact that a corkscrew must be employed, a difficult, clumsy and inefficient job at all times, and we are not sure whether odd bits of cork in our drink is really a good thing. Surely, at the price, we deserve a better system—a threaded bottle and a threaded stopper. Plastic stoppers of the polythene type act as self-sealers.

As for wine, we always consider the cork an unknown quantity, one that may ruin cheap or good wine with equal impartiality. The plastic accurately tapered "cork," especially that of the inert, slightly elastic or comparatively soft type, would appear to be ideal.

Death of Julius Veit

On going to press we learn with great regret that Mr. J. Veit, of Duratube and Wire, Ltd., has died of heart failure, following a long period of illness.

Telephone, as used in aircraft of the King's Flight, moulded in Beetle by The General Electric Co., Ltd., and exhibited by British Industrial Plastics, Ltd.

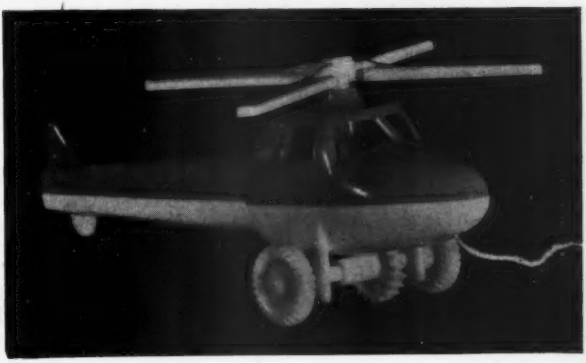
More High-lights at the B.I.F.

As we prognosticated in our last issue, we encountered more high-lights at the 1948 B.I.F. than we knew of. Some of these, of course, had been withheld, especially by moulders, to make a special announcement at the Fair, or by a strange shyness generally due to the fact that the final seller did not wish the name of the moulder known!

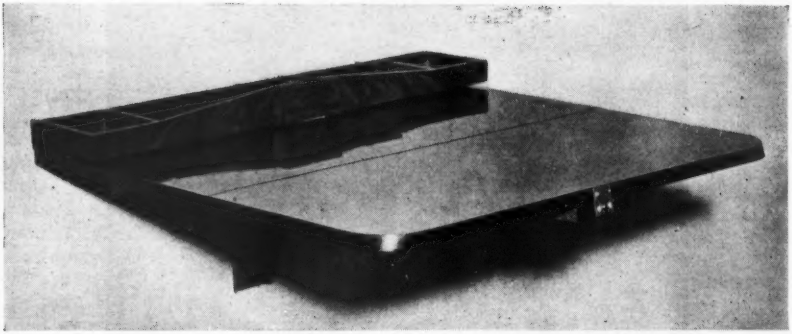
However, in no particular order here are some of the good things we saw.

British Industrial Plastics, Ltd. This company now makes a new moulding powder entitled Beetle plasticized moulding powder. This facilitates greatly the moulding of objects carrying metallic inserts, so that the electrical industry is especially affected. We have secured a replica of the telephone used by H.M. The King in the Viking aircraft of the King's Flight during the Royal Tour in South Africa. This instrument was moulded from this special Beetle plasticized moulding powder by the makers, The General Electric Co., Ltd.

Injection Moulders, Ltd. While our own preferences normally gravitate to the generally "not-so-attractive technical



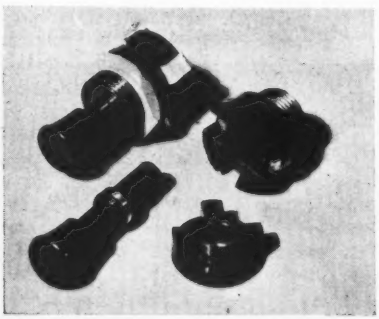
The first British-made injection moulded toy helicopter. (Injection Moulders, Ltd.)



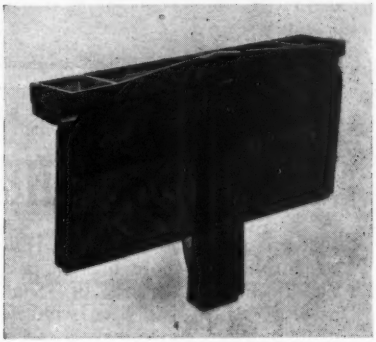
Folding wall table of Dufaylite, shown open and closed, as used in the de Havilland "Dove" aircraft. (Dufay-Chromex, Ltd.)

and industrial mouldings," we must admit that the toy helicopter which this company showed for the first time deserved a special mention, so ingenious the idea, so excellent the execution, and so attractive to the young and not so young. Much thought has gone into this production, as will be seen in our photograph of the construction showing the gears which turn the airscrew when the helicopter is dragged over the ground. It is a two-colour job in cream-white and maroon, overall length 4¾ ins.

Dufay Chromex, Ltd. In addition to the Dufaylite aircraft wing and the Dufaylite wall structures of the "Viking"



Miniature push-button switch for electronic circuits, designed by Painton and Co., Ltd., and moulded in nylon-filled Bakelite material. (Bakelite, Ltd.)



shown in our last issue, we were intrigued by the ultra-light folding table made from the same material, and which is incorporated in many de Havilland "Doves." The honeycomb structure of Dufaylite will find a ready market where every ounce saved is important and where strength is essential.

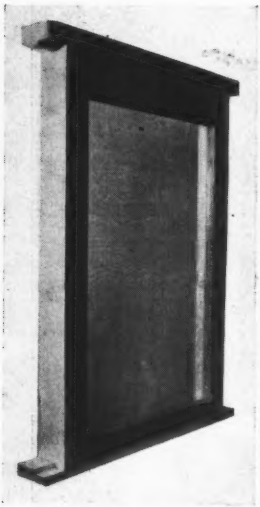
Bakelite, Ltd. At this stand we noted several new developments, in addition to the new production of Vybak resin (a vinyl copolymer) and the rigid sheeting made from it. We refer more especially to the new surface finish introduced into Warerite in the form of narrow flutes running the length of the sheets and also to the new patented grade of nylon-filled Bakelite moulding resin. This latter is especially useful for producing electrical equipment of high dimensional stability under humid conditions and high retention of insulation resistance.

Injection moulded polystyrene tiles of colourful appearance and with a highly polished surface, unaffected by moisture or soap, are used in this modern bathroom. (Stone and Simmons, Ltd.)

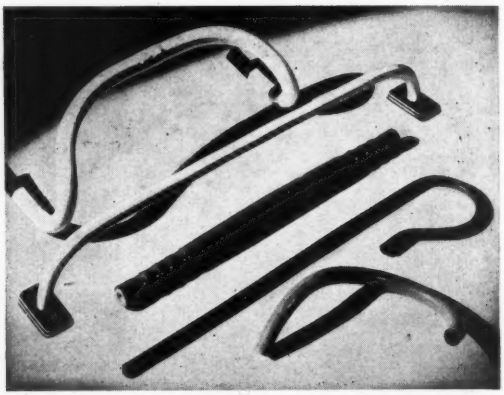
Stone and Simmons, Ltd. This concern, relatively new to the industry, has rushed in where most others have feared to tread, by the introduction of plastic wall tiles. And, if we may say so, the rushing has not been foolishly done; at any rate, it is bravely done, and we wish it success, for it is high time that this was introduced, mainly because of the scarcity of wall tiles generally, but also because, fundamentally, we believe that they are an improvement on the porcelain type. Those made by this concern are of polystyrene and injection moulded. An improvement should be attained when the process is carried out on a multiple mould and the sprues taken to the edge of the tile and not the centre, as they are at present.

I.C.I. (Plastics Division). As we have already indicated, emphasis at this stand was laid on the new thin polythene sheet, with its high strength, acid-resistance and non-permeable properties, making the product an excellent wrapping material for most things, from pickled onions to

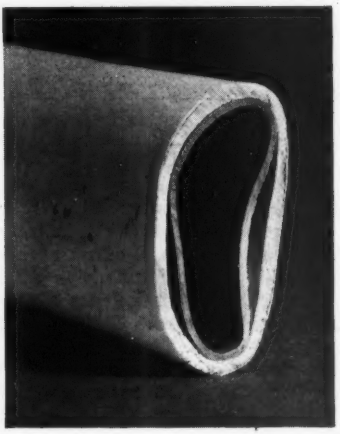
Machine for heat-sealing polythene, exhibited by I.C.I. (Plastics Division.)



"Tygan" woven net is fitted to this window frame to prevent the entry of insect pests. (Fothergill and Harvey, Ltd.)



Application of "Celastoid" tube stretched over wood and metal inserts. (Below) Toughness of the plastic is demonstrated by this crushed section. (British Celanese, Ltd.)

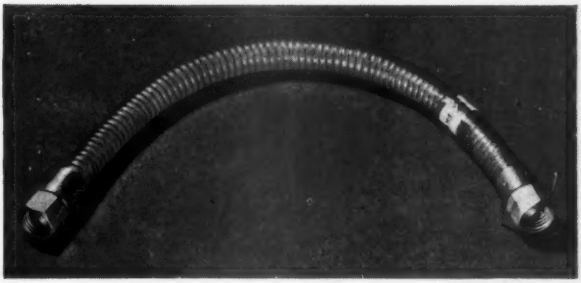


chemical powders. One container for carrying aniline hydrochloride, a valuable dyestuff intermediate, was lined with the film in the form of a closed bag, for export duties.

The heat-sealing of the polythene was exhibited on a machine developed by A. H. Bland, Northolt, Middlesex. The heating is provided by an electrically heated metal spiral, the sticking of the polythene to the heater being prevented by interleaving with a secondary film of great heat resistance.

Fothergill and Harvey, Ltd. We cannot resist including a photograph of one of the products of this concern, which, while famous for its "natural" textiles and is not inside the industry, has gone out wholeheartedly with Tygan, the raw material of which is produced by BX Plastics, under the name of Bexan. This new monofilament is being woven into lovely fabrics, but, to us, the most important use has a small field compared with that of textiles. It is that of mosquito- and fly-net production, and we hear that much interest is being taken in it by farmers and food producers in general. It cannot rust or otherwise deteriorate, so that its life should be much longer than the old metal-wire type.

British Celanese, Ltd. Among the manifold uses of the cellulose acetate made by this well-known company we select for special mention its recent development of extruded plastics, which, while not new to the world, is being tackled in a resolute manner. Certainly,



Flexible metal-spring tubing, coated with Geon for petrol supply in aircraft, exhibited by British Geon, Ltd.

to date, the world has seen little of it beyond the covering of bus rails and steering wheels, but we can conceive its ready acceptance outside these isolated uses. British Celanese, for example, is tackling the perambulator-handle field and also general furniture, especially of the metal tubular form. Nor will cross-section be restricted to the circular shape, for square and oblong cross-sections are already being made. The world has long discovered that uncoated metal for most purposes is neither desirable, warm to the touch, or colourful. It will soon discover that the best, strongest and most lasting covering is a thermoplastic. As an experiment, we crushed a sample of Celastoid-covered metal under very high pressure. As will be seen from the photograph on page 286, the metal remained crushed and was cracked at one point. The tough plastic is virtually unharmed and has "attempted" to retain its original shape.

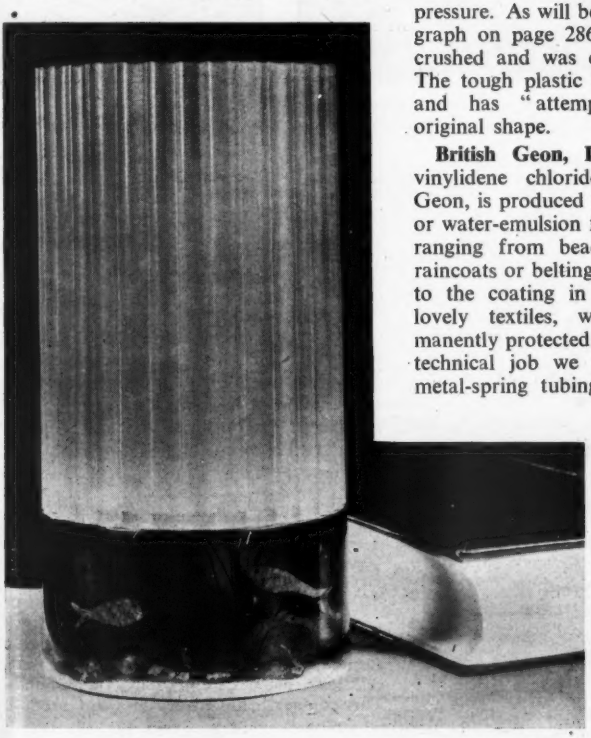
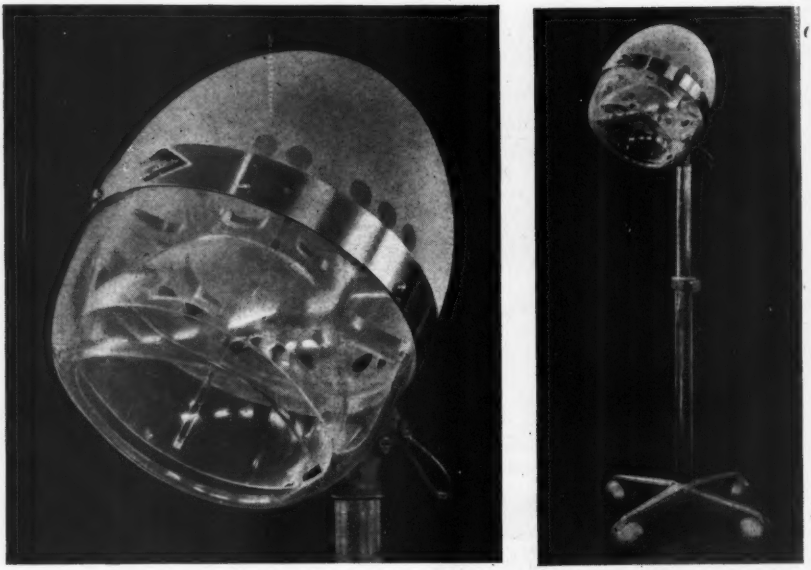


Table-lamp, in cast resin, by Erinoid, Ltd.

British Geon, Ltd. The p.v.c.-poly-vinylidene chloride plastic known as Geon, is produced in rigid, flexible, paste or water-emulsion form for various jobs, ranging from beading to sheeting for raincoats or belting, and from book-cloth to the coating in transparent form of lovely textiles, which are thus permanently protected. The most interesting technical job we saw was the flexible metal-spring tubing, coated with Geon, for carrying petrol for aircraft work. It is manufactured by Bardex Engineering, of Chertsey.

Erinoid, Ltd. Apart from exhibits of casein, of cellu-



The "Stanelect" pedestal hair dryer (Standard Electrical Engineering Co., Ltd.), with composite hood moulded from acrylic sheet by Mica Products, Ltd.

lose acetate and p.v.c. in every shape and form, we were delighted to see two superb examples of how Erinoid's raw materials can be used. The first was a settee covered with a delightfully warm pastel shade of p.v.c. that would add grace and dignity to any parlour—palace's or mayor's. The second was an especially lovely lamp entirely executed in cast resin, the base giving a peep under sea. The green-coloured liquid resin had been poured on to the denizens of the deep and allowed to solidify in situ.

Mica Products, Ltd. At this stand we were particularly interested in a pedestal hair dryer intended for busy hairdressing saloons where it is necessary to reduce "drying time" to a minimum. Here, a transparent acrylic sheet moulding is used for the hood casing, which covers the person's head, and the transparency of this hood allows the operator to see at a glance that the hair is dry. Another acrylic moulding is used for the rear portion of the equipment, where it covers the motor, heaters and fans, but this moulding has a translucent finish. By a unique arrangement of two fans, one at each end of the motor, the heated air is prevented from blowing over the face The hood is mounted on a sturdy pedestal, provided with castors and adjustable for height. Mica Products, Ltd., make the acrylic component parts and also the mica elements used in the heaters. The complete assembly is supplied by the Standard Electrical Engineering Co., Ltd., 16, Heneage Lane, London, E.C.3.

Corrections

On page 249 of our May issue, Mr. A. E. Davey's name was inadvertently spelt "Davies."

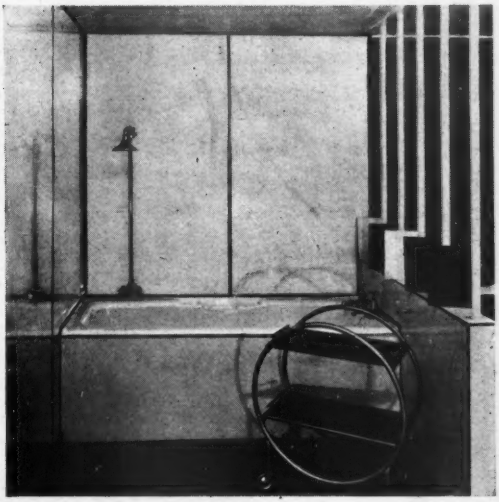
Referring to the tabular summary of exhibitors given on page 185 of our April issue, we regret that we omitted to mention Erinoid, Ltd., as manufacturers of casein, cellulose plastics, and vinyl compounds. This company, moreover, does not produce laminates.

B.I.F. 1948

ON the pages which follow we give further illustrations of stands which were in the Plastics Section of the Fair at Earls Court; also some of those of plastics interest at the Engineering and Hardware Section at Castle Bromwich. In the relatively new field of high-frequency heating, there were at least six exhibitors at this year's Fair. Various improvements in the design of presses and injection moulding machines were also to be seen, and to some of these we hope to make further reference in later issues. Displays by several well-known concerns at Castle Bromwich included a wide range of technical plastics for the general engineering, electrical, building and aircraft industries.

Don Tyle, Ltd., one of the exhibitors of building materials at Castle Bromwich, provided a display of polystyrene tiles made by injection moulding. A kitchen sink unit and pedestal lavatory were shown in appropriate tiled settings. These plastic tiles were used throughout for the construction of this stand, and the range of colours available was blended in a rainbow effect on the supporting pillars.

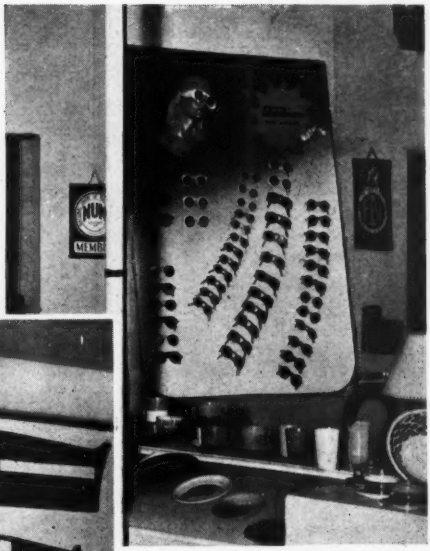
(Above) A colourful arbour of flowers, all made from polyvinyl chloride, was seen at the stand of Dalebrook, Ltd. The general effect, so different from that of any other stand in the Plastics Section at Earls Court, was most refreshing.



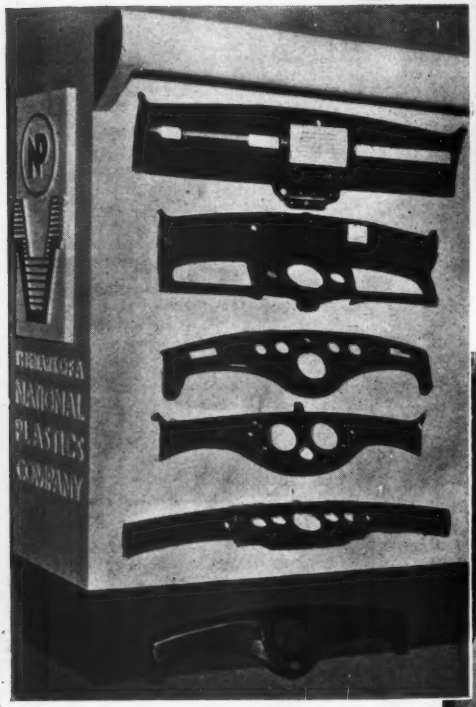
Decorative laminated plastics were featured at Earls Court by North British Plastics, Ltd., who included a bathroom panelled with some of their materials.

B.I.F., Earls Court

(Below) Thermosetting mouldings exhibited by British Moulded Plastics, Ltd., ranged from one-piece instrument panels for aircraft and motorcars, to component parts for small electrical accessories in the motorcar trade. The aircraft instrument panel at the top of the illustration includes a central radio grille.



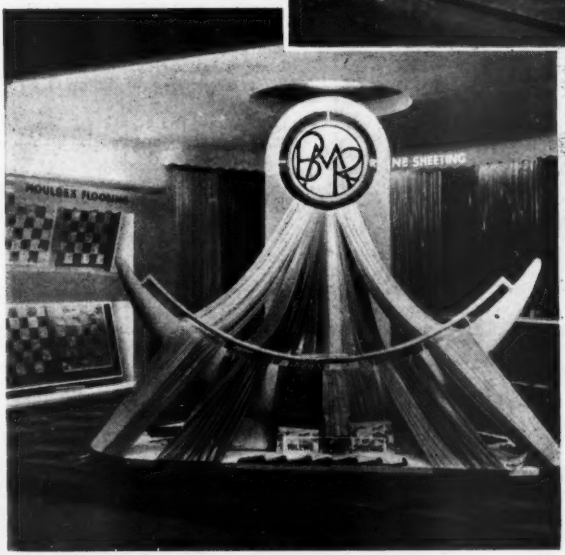
(Above) Sun-glasses and domestic ware, including a special picnic set for the export market, were displayed by Stadium, Ltd.



(Right) Cellulose-acetate-butyrate extrusions for toy flutes and fountain pen components were seen at the stand of De La Rue Insulation, Ltd.

(Left) Hill, Norman and Beard Plastics, Ltd., exhibited a comprehensive range of articles fabricated from "Formica," "Delaron" and "Trafolyte" laminated plastics.

(Right) Furnishing material and Walt Disney inflatable toys were shown by Dunbee, Ltd. On their visit to Earls Court, Their Majesties, The King and Queen, showed particular interest in the furnishing fabrics at this stand, and Dunbee, Ltd. were requested to forward a complete range of samples to Windsor Castle.



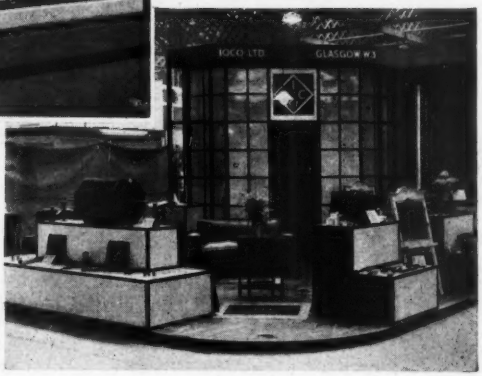
B.I.F., Earls Court

(Left) British Mouldex Rubber Co., Ltd., made a special display of "Rilene" p.v.c. sheeting in a standard range of over 30 colours, together with many exclusive registered designs in printed sheeting, which were a departure from tradition in this particular field.

(Above) The exhibit by Ashdowns, Ltd., demonstrated the virtues of "Ashlam" synthetic resin-bonded boards for electrical insulation and mechanical applications, and of silicone bonded glass-cloth for high-temperature insulation.

B.I.F.,
Castle Bromwich

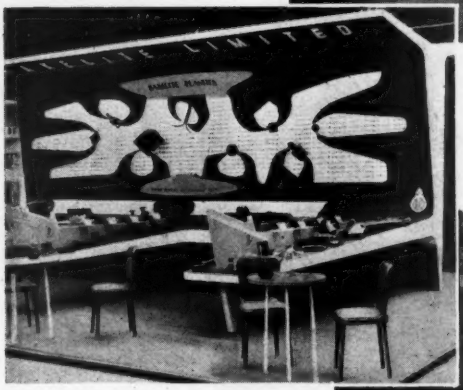
(Above) Evered and Co., Ltd., displayed a comprehensive range of "Everite" builders' hardware and mouldings for other trades.



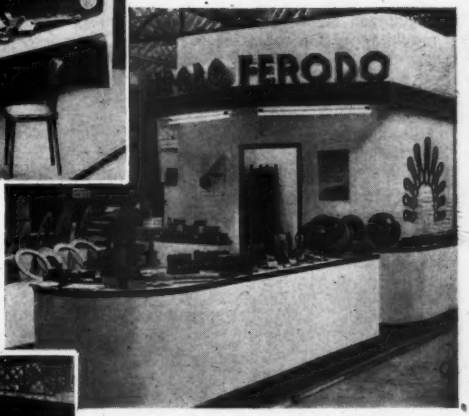
(Right) loco, Ltd., showed laminated sheet, electrical insulation, and "Zapide" vinyl-coated fabrics.

B.I.F.,
Castle Bromwich

(Right) Birkbys, Ltd., exhibited phenolic mouldings, moulding powders, resins for all bonding, laminating and impregnating purposes, and completely assembled articles utilizing various "Elo" products.



(Left) Bakelite, Ltd., concentrated the attention of the visitor on nine outstanding applications for Bakelite in all their forms.



(Right) Ferodo, Ltd., showed a range of laminated materials with an asbestos base, typical applications for which included brake linings, fan belts, stair treads, etc.

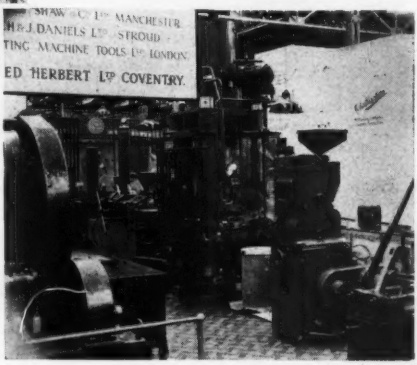
(Left) A. C. Wickman, Ltd., provided evidence for the excellent cutting qualities of "Wimet" tungsten carbide; a vitrified abrasive wheel formed by a standard cutting tool was exhibited alongside the actual tool used.

B.I.F., Castle Bromwich

(Left) E.M.B. Co., Ltd., made a special feature of their new injection moulding machine, with examples of mouldings produced by it.

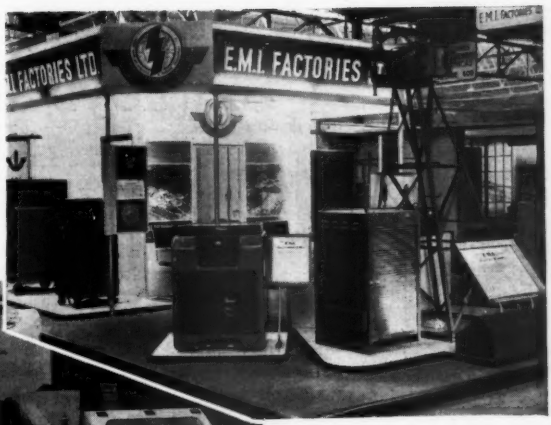
(Right) Bradley and Turton, Ltd., had their 100-ton self-contained semi-automatic moulding press in operation.

(Left) Finney Presses, Ltd., showed some entirely new designs in plastics machinery, including pneumatic pelleting equipment.

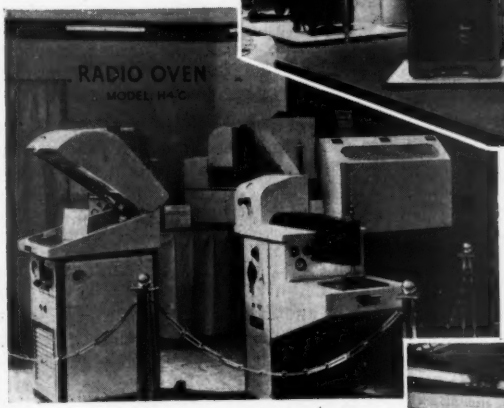


(Right) Francis Shaw and Co., Ltd., T. H. and J. Daniels, Ltd., and Alfred Herbert, Ltd., combine their resources for a most comprehensive display of machinery for the plastics industry.

B.I.F.,
Castle Bromwich



(Right) E.M.I. Factories, Ltd., showed a range of radio frequency equipment for the plastics industry.



(Left) Radio Heaters, Ltd. another exhibitor of radio frequency equipment, included preheating ovens and plastic sheet welders.

(Right) Delapena and Son, Ltd., a third exhibitor in the same class, had heaters embodying automatic lid opening, process timing, and a well-lighted heating chamber.

(Left) Schori Metallising Process, Ltd., gave a working demonstration of the flame-spraying of polythene; various polythene-sprayed articles were exhibited, including wringer parts, suitcases and aircraft seats.

L

World's Industry Employs Plastics

GENERAL ENGINEERING

Sandwich Material.—A metal-faced balsa-cored sandwich material (Metalite) appears to be competitive with usual all-metal construction. Cycleweld cement and phenolic resins form the bond, while hollow rivets or aluminium-alloy bolts give high joint efficiencies. (S.A.E. Quarterly Trans., 1947/July/415.)

Laminated Beams.—T. R. Truax and M. L. Selbe report on accelerated tests and long-term exposure on glue joints in laminated beams. The applied test is based on the principle that severe shrinking and swelling of laminated members produce stresses which cause checking of wood, failure of glue joints, or both. (A.S.M.E. Preprint No. 47-A-85, Dec., 1947.)

Machine-tool Protection.—A low-cost hot-melt compound (Eronel Industries, 2714, W. Pico Blod, Los Angeles, Calif.) for protecting machine tools during skipping and handling is pale amber in colour and transparent, thus enabling identifying marks to be easily read. ("Machinery," N.Y., 1948/Mar./197.)

Powder Metallurgy.—In a general survey on major advances in plastics during 1947, J. W. Underwood deals with the application of powder-metallurgy techniques in the manufacture of plastics, in particular the moulding of polytetrafluor ethylene, polyvinyl chloride pastes, the compounding of moulding materials, the forming thermoplastic sheet stocks, the preheating thermosetting materials, silicone resins, etc. ("Mechanical Engineering," 1948/**70**/298.)

Glass Bonding.—Data for contact angles, surface tension and tensile strength of adhesive bonds for glass have been found by F. Moser (A.S.T.M. Bulletin, 1948/Jan./51) for 14 different adhesives, such as phenol, phenol-butyral, vinyl-phenol, Buna-N-phenol, Buna-N-resin base, which gave bond-strength values above 1,000 lb./sq. in.; some other plastics gave extremely low values.

Mould Design.—In a series of articles on the design of moulds for plastics W. S. Thomas deals with movable-core designs and core-actuating mechanisms. ("Toolmaker," 1948/Mar./106.)

Mechanical Tests.—D. Telfair, C. H. Adams and H. W. Mohrman report on comparison tests on creep, long-time tensile and dynamic flexural-strength properties of some commercial melamine and phenolic plastics. (A.S.M.E. Transactions, 1947/Oct./789.)

Mould cooling.—In answer to a query concerning the quantity of water necessary to cool six steam-heated plastic moulds, it is recommended a test controlled by temperature measurement of the water at inlet and outlet be made. ("Practical Engineering," 1948/Mar. 26/268.)

MISCELLANEOUS

Golf Balls.—Silicone "bouncing putty" for golf-ball centres is said to give the ball improved distance, "click" and "feel." In addition, a new electronic thread-winding device will produce balls of uniform playing performance. ("Mechanical Engineering," 1948/**70**/343.)

Wooden Barrels.—Recent tests reveal greater strength of laminated-stave,

plywood-head barrels of 50 gallons capacity, which withstood dropping from heights of 48 to 51 ins., compared with solid-stave barrels, which withstood maximum-drop heights of only 24 to 27 ins. (A.S.M.E. Preprint No. 97-A-127, abstracted in " Mechanical Engineering," 1948/**70**/359.)

Marking Technique.—J. F. Cerness recommends the use of a " Speedball " pen with an ink composed of methylene chloride and a little dye for marking the Lucite mounts of metallographic specimens. (" Metal Progress," 1948/Mar./371.)

Gasket Material.—A special synthetic rubber meeting the exacting requirements of O-ring packing and gasket material for static and dynamic sealing of aircraft hydraulic systems has been developed by Parker Appliance Co., Cleveland, Ohio. (" Machinery," New York, 1948/Mar./197.)

Underground cables.—The advantages of neoprene-jacketed underground cables are stressed in a short article. They are light and flexible, and easy to install, especially when laid in ducts. (" Wire and Wire Products," 1948/Mar./249.)

Plastic Insulation.—The production of insulation on the basis of polyvinyl chloride and polythene by improved extrusion methods has been described. (" Wire Industry," 1947/Sep./501.)

Radio-frequency heating is finding wider application in the woodworking industry for edge-glueing, plywood manufacture, drying and assembly glueing. (A.S.M.E. Preprint No. 47-A-115, abstracted in " Mechanical Engineering," 1948/**70**/358.)

Leather finishing.—Two new resin emulsions for the leather-finishing industry may be converted to tough, flexible resins providing a clear, colourless film of low water absorption. No plasticizers are used and no emulsion film-hardening occurs from evaporation. (" Business Week," 1948/Feb./60.)

Combs.—It has been suggested that the mould for a plastic comb may be made from a mild-steel master in two parts, subsequently copied by pantograph. (" Practical Engineering," 1948/Apr. 9/320.)

Silicones.—Properties and flexibility of silicone sponge (Connecticut Hard Rubber Co., 407, East Street, New Haven, U.S.A.) stay unchanged over wide temperature range (500 degrees F. to minus 70 degrees F.); it has low cost (because the weight is only that of solid silicone rubber). (" Business Week," 1948/Mar. 20/77.)

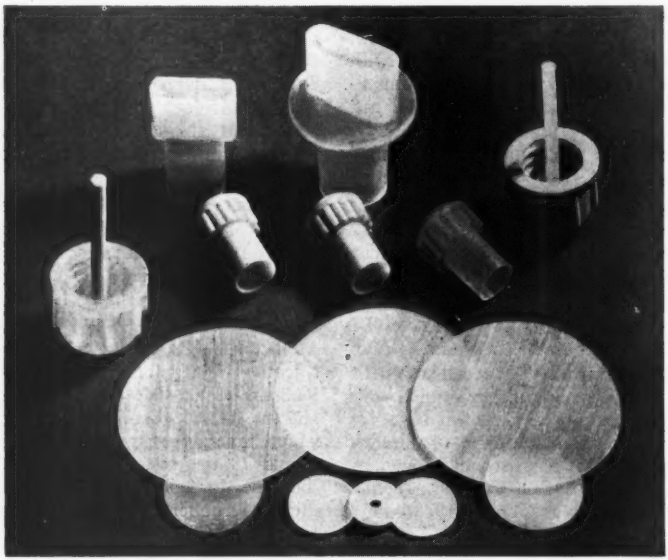
Permanent magnet rings (Norton Trading Co., New York) have half the specific gravity of iron. The production method is not disclosed, but certain ferrites are said to be mixed with a plastic base. (" Popular Science," 1948/Apr./107.)

Synthetic Rubbers.—V. A. Cosler and S. W. McCune report on advances in synthetic rubber as regards design and testing during 1947, with a bibliography. (" Mech. Engineering," 1948/Apr./307.)

Plumbing systems. — Hydraulic engineers at the National Bureau of Standards are making a study of plumbing systems, using pipes made of plastics. (News Bulletin, Nat. Bur. Standards, 1947/**31**/144.)

SOURCES OF REFERENCE

We wish to remind readers that the sources of reference from which these pages are compiled are not, in general, retained in this office. We cannot, therefore, undertake to supply such originals. Nevertheless, most of the foreign journals referred to are available in the Patent Office Library (Southampton Buildings, Chancery Lane, W.C.2) and in the Science Library (South Kensington). Photo-duplicated copies of articles may be obtained from the Photostat Dept. of the Patent Office.



Polythene Closures for the Pharmaceutical Trade

by N. H. Pickering,* B.Sc., Ph.C., A.R.I.C.

The author, who has for many years worked in a scientific capacity in the manufacture of pharmaceutical compounds, has now turned to the production of high-quality stoppers for bottles holding these expensive compounds, which may be volatile, corrosive, oxidizable or otherwise affected by outside influences. The new stoppers he describes make for many safeguards and for absence of waste.

IT is not surprising that pharmacists conversant with the chemical properties of polythene have realized that in this material they have a valuable addition to the range of bottle closures especially available to them. The exceptional chemical resistance is amply described in a technical bulletin issued by the manufacturers of "Alkathene" (brand of polythene), Imperial Chemical Industries, Ltd. The indications are that, in general, concentrated mineral acids and alkalis have no effect on the material after several months' storage at normal temperatures. It does not support fungoid or bacterial growth, it is tasteless and odourless and, even in thin sections, is an excellent moisture barrier. Physically it is a tough, opaque, waxy solid, possessing a resilience which makes it eminently suitable for the purpose suggested in the title. It can be moulded into intricate shapes which are of uniform and accurate dimensions. Lastly, such mouldings are virtually unbreakable, even by blows from a hammer!

With these facts in mind it is obvious that polythene mouldings are of great interest where inert closures are indicated.

*Amplex Appliances, Hayes, Kent.

Wads, discs and liners have been in general use for some time and their applications are increasing continuously. These are punched from sheet and are available in thicknesses ranging from 0.004-in. to 0.100-in. The thinner material is intended to be used as a facing for the more usual cork or paper type of wad, while the thicker is used alone.

These closures have been effectivety used with solutions containing volatile organic solvents (nail varnishes), spirits, wines, bleaching solutions, corrosive, hygroscopic and deliquescent chemicals, preparations of the vanishing cream types where there is a risk of evaporaton of the aqueous content, and nikethamide and preparations and extracts of glandular products with their attendant risks of fungoid contamination from the less resistant types of wads.

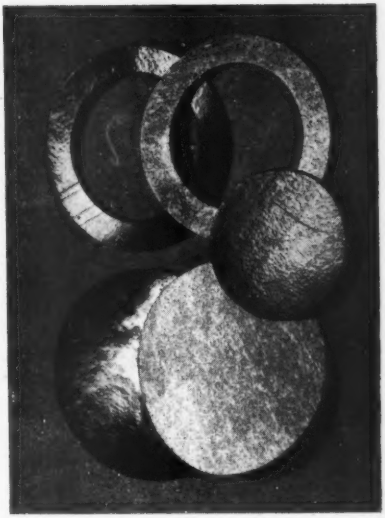
The alleged disadvantages of using a thick polythene wad with its possible insufficient resilience has been entirely overcome by the recent introduction of a cork-polythene disc now being manufactured, having a glazed fused facing of pure polythene. This new material combines the resilience of cork and the chemical resistance of polythene. It also has the advantage of lower cost.

Screw caps are manufactured having a central internal tapered, protruding, hollow core. This projection is so dimensioned that it is pushed tightly into the mouth of the bottle as the cap is screwed down. The ensuing seal is positive and permanent, no wad being required for this purpose.

The outside shape of the cap and the colour of the material can be so arranged to give a blend of contour and shade with the container, label and contents.

Cores are also designed to accommodate a length of polythene rod giving a pliable and unbreakable dropper for the application of antiseptic collodions and varnishes.

Stoppers are made in a variety of shapes and sizes and again consist of a hollow stem. The resilience of the material and the calculated thickness of the wall are sufficient to enable a given stopper to fit perfectly and even to adjust itself to any normal irregularities occurring in the mouths of any bottle in a particular range. The elimination of the individual grinding of a glass stopper, and the subsequent danger of accidental interchange of such stoppers with the resulting leakage or evaporation of the contents, is an important consideration. The hazardous process of loosening a firmly embedded glass stopper from a bottle is also banished.



Washers and wads of cork-polythene with fused facing of pure polythene.

In addition to the conventional type of stopper for both narrow and wide mouth bottles, there are also available mouldings with a horizontal platform to serve as a dust cap.

Most of the above are moulded from natural polythene, but occasions have arisen where coloured stoppers have been used as a means of identification or warning. Individual trade marks or names can be incorporated as an embossing on the finished article.

New Trends in Furniture

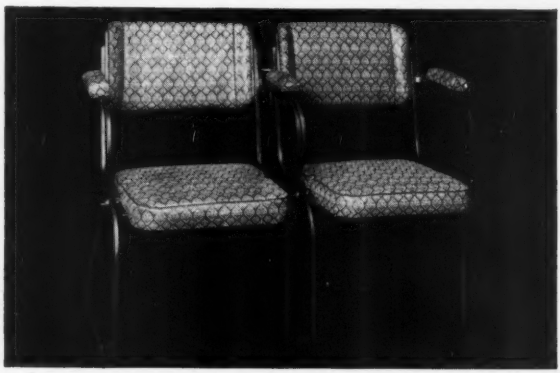
THE golden days of the Egyptian, Greek and Roman Empires saw the evolution of much beautiful bronze furniture, in the form of castings enriched with much decorative work and gold overlays, in the houses of the nobility.

If we jump to the first half of the 19th century, we find that opportunity was taken to profit by the abundance and cheapness of metal (in the form of cast iron), and much cheap furniture, including chairs and seats of all kinds for domestic and public use, were manufactured in this material. Designs were frequently over-elaborate and ill-considered, and the full possibilities offered by metal in place of wood were rarely, if ever, studied. There was a tendency to adhere too slavishly to concepts already stagnated by too long practice. Metal was used either as a method of convenience for factory production, or because it could better be relied upon to withstand the rigours of outside use or public service.

The end of the late war saw the beginnings of a recrudescence of metal furniture, generally made from extruded steel and aluminium tube, "practical" perhaps but bearing little or no impress of traditional work and sometimes far from beautiful. A new movement of a much more acceptable form, in which the influence of tradition is clear, is now perceptible in the work of the famous firm of J. Starkie Gardner, Ltd., of Wandsworth. Here not only is advantage taken of the lightness of aluminium and ultra lightness of magnesium, but wedded with them is an adherence to traditional taste, and, more important to our own industry, a strong realization of the part that can be played by the adoption of plastic materials in various forms.

The achievement of traditional chair forms in magnesium, illustrated here, was approached through aluminium prototypes, from which new methods of construction were evolved, and, for economic as well as technical reasons, was attained by the use of cast components. That this was possible to a degree beyond the powers of aluminium to fulfil, is to be explained by the remarkably low specific weight of the metal, enabling stout sections to be used without undue increase in mass. Novel methods of assembly help in gaining this objective.

Magnesium may be finished by means of air drying or stoving lacquers, and for many purposes these, in a variety of colours, give excellent results. Like all such finishes, with few and rather expensive exceptions, they are vulnerable to rough usage and may be chipped. The development of the flame-sprayed polythene coating by means of the Schori powder pistol, provides a solution to this problem. Not only is the film, if properly



Tip-up seats with detachable arm rests in magnesium alloy, for theatres, concert halls and lecture rooms. The upholstery is a fabric coated with p.v.c. for durability and ease of cleaning.

Wrought unalloyed aluminium table with fine scroll enrichment; the top is of p.v.c. embossed sheet.

applied, remarkably adherent; it is leather-like in its toughness and scratch-resistant, but it also possesses the advantages of warmth and softness to the touch. Polythene coatings may be pigmented to suit any colour scheme in pastel shades and are devoid of odour frequently associated with paints.

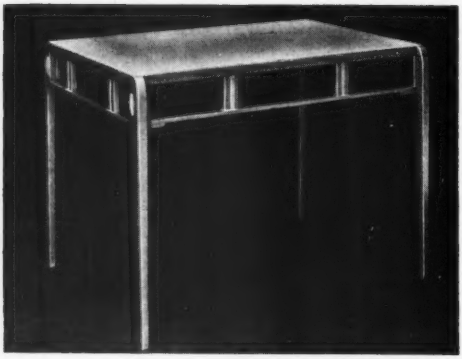
Latest developments in the hands of craftsmen indicate that magnesium can be used with ingenuity in design and construction for dining-room and bedroom suites. Wood veneers and plastic fabrics applied over dovetailed and bolted cast components, exposing only delicate projection or flush members as an integral part of the construction, will give a quality and refinement not hitherto attained in any metal furniture.

Thus we also see in the accompanying photographs the use of "Holoplast" for table tops, both for decorative and essentially useful purposes; of p.v.c. embossed sheeting (here "Melloride," by Mellowhide Products, Ltd., was employed); or "Delaron" (De La Rue Insulation, Ltd.) laminated sheeting for chair seatings, and decorative p.v.c.-coated fabrics for chair backs.

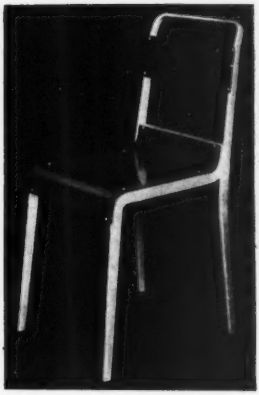
We shall watch this new endeavour of Starkie Gardner's with interest. We are indebted to this concern for the photographs which accompany these notes.

(Above) Stool of cast magnesium alloy, with seat of p.v.c. sheet

(Right) Decorative wrought metal table; the top is of "Holoplast," covered with embossed p.v.c. sheet.



(Above) Stacking table with light-weight top to design T.S.12; the top is coated with embossed p.v.c. sheet.

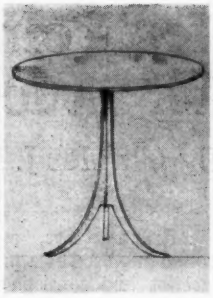


(Above) Chair to design C.S.11, especially designed for stacking; the seat and back-rest of laminated sheet ("Delaron"); the frame polythene sprayed. (Below) The same chair, as stacked.

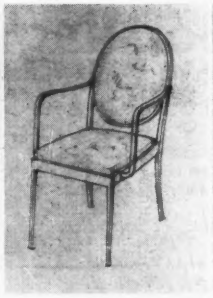
(Right) Magnesium chair, upholstered with p.v.c. coated fabric; the whole of the frame is polythene sprayed.

(Left) Magnesium circular top table to design T.6, with "Holoplast" top.

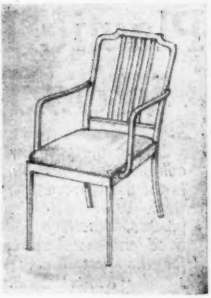
C.D.5



T.6



C.D.C.7



C.D.C.8

Design C.D.5

Chair of oval back design with drop-in upholstered seat and back. Height, 3 ft. 1¼ ins.; width, 1 ft. 4¾ ins.; depth of seat, 1 ft. 2½ ins.; total weight, 16¼ lb. Upholstering in p.v.c. coated fabric.

Construction: Back and back legs cast in one. Front legs and front cross-member also cast in one. Each side-member cast separately. All bolted together at corners. Bolts cast in. Back of upholstery masked with the addition of a light-gauge magnesium cover sheet held in position by small screws. Exposed metal frames coated with sprayed polythene.

Design T.6

Circular-top table. Height from floor, 2 ft. 4¾ ins.; average diameter of top, 2 ft. 6 ins.; total weight, 15¼ lb. (with 2-ft. 6-in. diameter top).

Construction: Top in ¼-in. thick Holoplast fixed to a three-way central support. Top of support arranged to take different size table tops.

Design C.9

Seat and backrest in ⅛-in. thick plastic-bonded laminate (Deluron) with dome-top fixing. Height, 2 ft. 9½ ins.; width, 1 ft. 3½ ins.; depth of seat, 1 ft. 3 ins.; total weight 8½ lb.

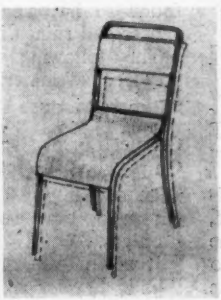
Construction: Front and back legs cast in one. The sides of the chair joined together by one casting forming back with additional extension piece running down between back legs to give extra rigidity. Light-gauge magnesium sheet fitted to frame under seat. No other cross-member. Metal frame entirely sprayed with polythene.

Design T.S.12

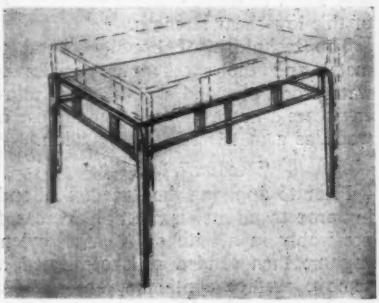
Stacking table with lightweight top covered with p.v.c. sheeting. Length, 3 ft. 6 ins. width, 2 ft. 3½ ins.; height, 2 ft. 6 ins.; weight, 36¾ lb.

Construction: Legs and end panels cast in one. Side panels fitted separately; screwed to end panel castings. All top members of rebated section to take table top. Table top held in position by screws from underneath.

C.9



C.S.11



T.S.12

Plastic Bonding for Composite Wood and Metal Structures

By Charles J. Moss, B.Sc.

During the past few years synthetic resin adhesives have made further advances possible in the use of wood as a material of construction. With the development of the "Redux" process, described in this article, rational wood and metal structures became possible for the first time. Various examples of "Redux" bonding are described.

DURING the past 10 years the introduction of synthetic-resin adhesives has made possible remarkable advances in the use of wood, and especially of plywood. The resistance to dampness and attack by bacteria, together with the gap-filling properties of these glues, are among their most striking advantages over "skin" and "hide" glues.

Until a year or two ago, when it was necessary to join wood to metal the designer would have specified a large number of bolts or screws. Although this is a simple solution it is hardly an efficient one, because of the low shear strength of the wood, which is usually about one-twentieth of the tensile strength compared with about two-thirds of the tensile strength for most metals. Since a bolted or screwed connection depends entirely on the shear strength of the wood, it will be seen at once what an inefficient method this is; it also raises the question whether metal can be used in conjunction with wood in some way so as to overcome the disadvantage of this low-shear strength.

The technique of bonding wood to metal and the excellent properties of waterproof plywood will together allow engineers a much more systematic use of wood as a material of construction.

"Redux" Bonding

Prior to applying the "Redux" bonding process, all metals must be degreased, preferably in a bath of trichlorethylene vapour; then sanded or shot-blasted to remove surface contamination, such as rust or scale. Freshly machined surfaces need only be degreased. For cleaning aluminium alloys, a chemical pickle commonly used as a preparation for spot welding and consisting of a mixture of sulphuric and chromic acids (D.T.D. 915A) has been found to be both reliable and effective where the best results are required. Anodized material, of course, must not be pickled or sanded; it should only be degreased. No preparation at all is needed for veneers, but it is advisable to sand plywood lightly.

"Redux" liquid K.6 is then brushed on the metal or plastic surfaces and powder is sprinkled on top of it. Because the "Redux" liquid remains tacky, the powder adheres to it quite well and any surplus can be removed by turning the object over and lightly tapping it. Instead of brushing on the "Redux" liquid resin, it may be applied by means of a glue spreader or by roller, and mechanical shakers may be used to apply the powder.

Plywood surfaces are also coated with a thin spread of the liquid resin, but do not require any powder. Veneers do not require either the liquid or the powder. With some veneers it would be a very serious disadvantage to apply a coat of resin, because, after bonding, it would be found to have penetrated through the veneer and ruined its appearance.

The following approximate spreads of "Redux" materials are required:—

"REDUX" LIQUID K.6	Per 100 sq. ft.
On metal or plastic surfaces ..	1-1¼ lb.
On plywood surfaces	1¼-1½ lb.
"REDUX" POWDER	
On metal or plastic surfaces only	1 lb.

It will be seen that plywood requires a slightly heavier spread than does metal because of its more absorbent surface.

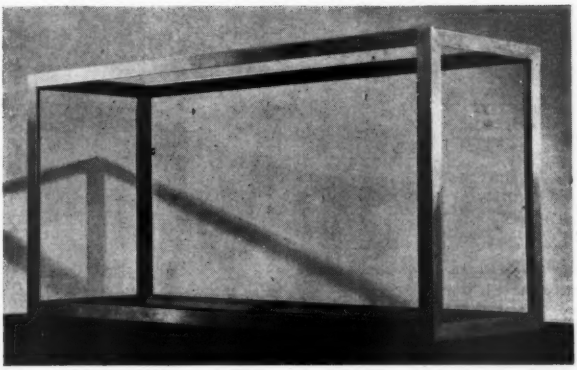


Fig. 1.—Showcase made from aluminium extrusions "Redux" bonded to wood, and subsequently assembled by means of cold-setting gap-filling glue (Aerolite 300).

The actual bonding process requires the application of a temperature of not less than 140 degrees C., and of a clamping pressure while the synthetic resin is "cured." At 140-150 degrees C. the "curing" time required is 15 mins.; at 170-175 degrees C. it is about 8 mins.; at 180-185 degrees C. it is only 3 mins. The pressure should be in the region of 200 p.s.i., but the exact amount is not critical, and good results can be obtained with much lower pressures.

There are many different ways of obtaining the necessary temperature cycle. The most direct method of all for small components is to clamp them together and put them in an oven, allowing sufficient time for the heat to "soak" through to the "Redux." Alternatively there are several different methods of electrical heating by means of radiant heating elements of the kind now commonly used in electric fires, by compact resistance wire-wound elements such as are used in soldering irons or "flat" irons, or by passing heavy currents through thin strips of steel. Each method has its own advantages and care should be taken in choosing the most suitable for any particular job.

Finally a steam-heated hydraulic press may be used provided that the volume of production justifies the capital expenditure. This is the method most favoured by aeroplane manufacturers, and is particularly suitable for the large areas of bonding required in aircraft production, or for veneering.

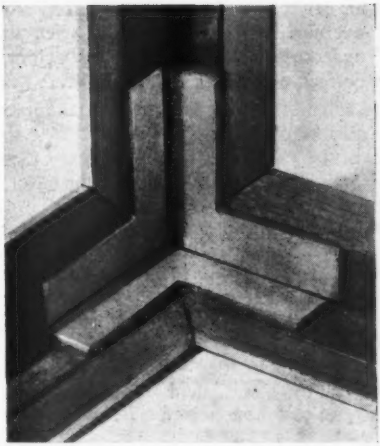


Fig. 2.—Inside corner of showcase, showing veneers bonded to extrusions; the L-shaped pieces of Duralumin are also veneered.

Inspection

Inspection for the satisfactory completion of bonding is a simple matter, for an examination of the edge of the joint between the metal and wood will show whether a suitable pressure has been applied, i.e., pressure sufficient to squeeze a little of the adhesive out of the joint, and the colour of this exuded material will show with a remarkable degree of

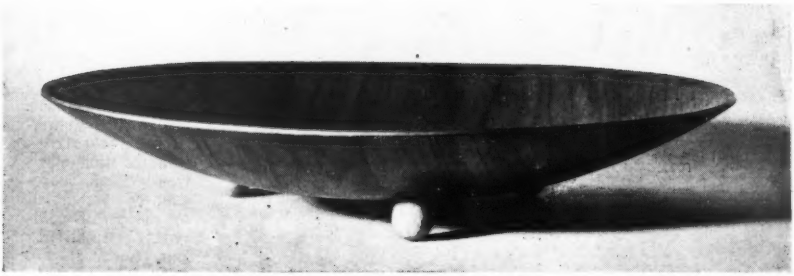


Fig. 3.—Veneered aluminium fruit bowl, pressed to shape after the walnut veneers have been "Redux" bonded to flat sheets of aluminium. (Only a high-strength glue will withstand such drastic treatment.)

certainty whether the temperature and time of "curing" have been correct. An "overcured" joint will be black; an "undercured" one, a light yellow colour; a perfect one, a dark reddish brown.

When inspecting veneered metal sheets a further check may be made. The sheet can be soaked in water and then examined. If the pressure or temperature have been faulty then the adhesion will be poor, and when the wood swells in water it will be able to part from the metal surface and form a blister. If bonding has been carried out correctly then soaking in water will not affect the bond.

"Redux" bonded joints are completely resistant to water, alcohol, petrol and any of the common solvents, as well as to attack by bacteria. In general, the strength of the bond is far greater than that of wood, including plywoods and hardwoods. This can be demonstrated by taking a piece of veneered aluminium and bending it over a 1-in. diameter bar. After a surprising amount of bending the wood fibres will part from one another, but their adhesion to the metal will still be good. This is the basis for many uses of veneered metal, because it can be formed into shapes having a large degree of single curvature and some even having double curvature.

"Redux" Bonding in Aircraft Construction

The de Havilland "Hornet," the fastest propeller-driven aircraft in the world, is mainly of wooden construction, but in

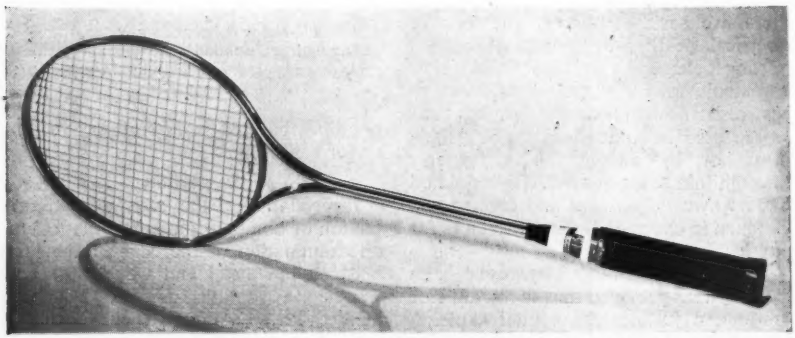


Fig. 4.—The wooden handle of this badminton racquet is bonded to a stainless steel frame; no press need be used when the racquet is put away after use. (Courtesy, Samuel Fox, Ltd.)

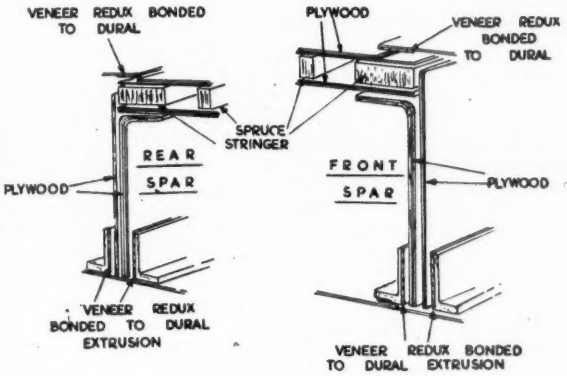


Fig. 5.—Details of spar design for de Havilland "Hornet" aircraft.

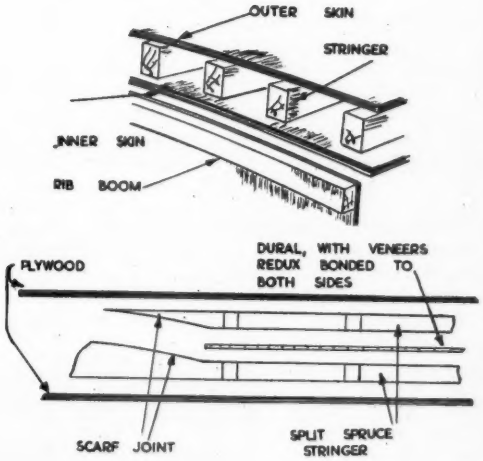


Fig. 6.—Details of skin reinforcement at joint in folding wing of de Havilland "Sea Hornet" and "Sea Mosquito" (top sketch shows the normal skin construction).

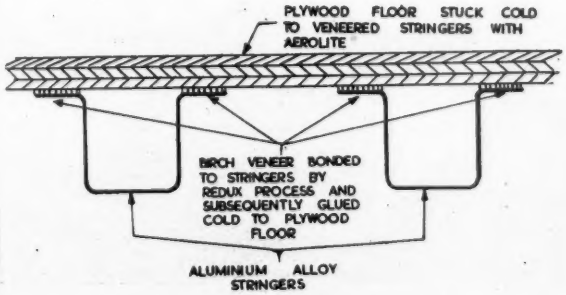

PLYWOOD FLOOR STUCK COLD TO VENEERED STRINGERS WITH AEROLITE
BIRCH VENEER BONDED TO STRINGERS BY REDUX PROCESS AND SUBSEQUENTLY GLUED COLD TO PLYWOOD FLOOR
ALUMINIUM ALLOY STRINGERS

Fig. 7.—Details of plywood floor, with aluminium-alloy stringers, for Vickers "Viking" aircraft.

order to obtain thin wings it was necessary to use a composite structure. If wood had been used for the whole of the wing spars, which are, of course, the main structural members and which carry the entire load of the aircraft, the wings would have had to be much thicker in order to accommodate the bulk of wood required to take the tensile loads. However, for such a fast aircraft aerodynamic considerations made it necessary to keep the wings as thin as possible, and hence wood could not be used to take the tensile loads. Thus a composite wing spar was designed, in which wood takes the compression loads, and aluminium alloy is used for the tensile loads. (For a full account of this interesting design see "Aircraft Engineering," February, 1947, pp. 46-47.)

The problem of how to weld the aluminium alloy to the wood was solved by the use of "Redux." First veneers were glued to the aluminium alloy in a steam-heated hydraulic press, and then the veneered extrusion was cold glued to the wooden web of the spar, as shown in Fig. 5. Because of the low shear strength of the wooden web it would have been quite out of the question to bolt the assembly satisfactorily.

The de Havilland "Sea Hornet" and "Sea Mosquito" had a common problem, because it was essential that these aircraft should both have folding wings. In the "Hornet" and "Mosquito" all the loads are distributed over the thick top-wing skin, but in the folding-wing Naval versions it was necessary to concentrate all the loads at the hinge points. To solve this problem a sheet of aluminium alloy was veneered on both sides and cold-glued into the wooden wing skin (Fig. 6). To provide additional strength at the actual hinge points, reinforcing sheets of "alclad" were bonded on locally to the main sheets. To quote from the makers' description: "In a wing like that of the 'Hornet' or 'Mosquito,' whose compression loads are evenly distributed over a thick wooden top skin, the concentration through two hinge positions, by means of reinforced light-alloy sheets, was an interesting problem, and one which would have been difficult to solve without the continuous surface adhesion provided by the 'Redux' cementing technique."

Floors for passenger aircraft should have walking surfaces free from rivet and bolt heads and yet should be light in weight. The designers of the "Viking" and "Viscount" have solved this problem by using a plywood floor, underneath which, and therefore out of sight, are aluminium alloy "stringers" (Fig. 7). These "stringers" are first "Redux" bonded to birch veneers, and then they can easily be cold glued to the underside of the floor, using a gap-filling, cold-setting glue, such as "Aerolite 300." The

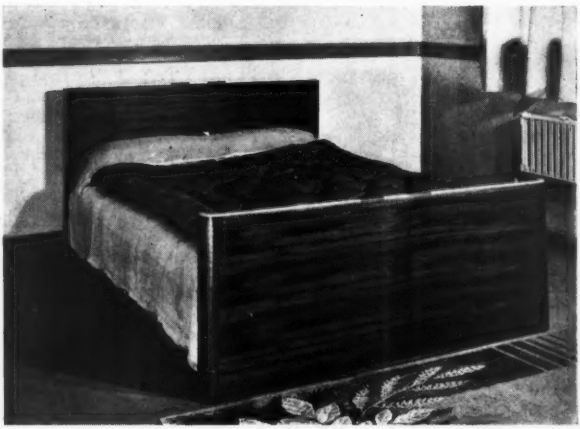


Fig. 8.—The ends of this modern bed are made from veneered aluminium panels.

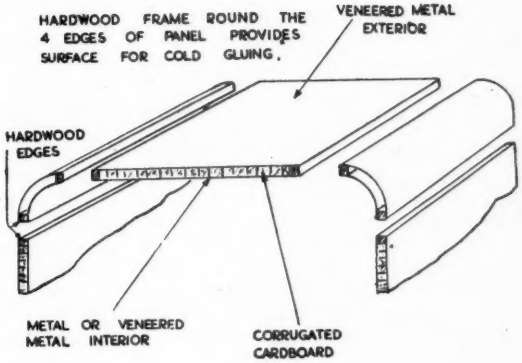

HARDWOOD FRAME ROUND THE 4 EDGES OF PANEL PROVIDES SURFACE FOR COLD GLUING.
VENEERED METAL EXTERIOR
HARDWOOD EDGES
METAL OR VENEERED METAL INTERIOR
CORRUGATED CARDBOARD

Fig. 9.—Curved and flat panels used as simple elements for furniture construction.

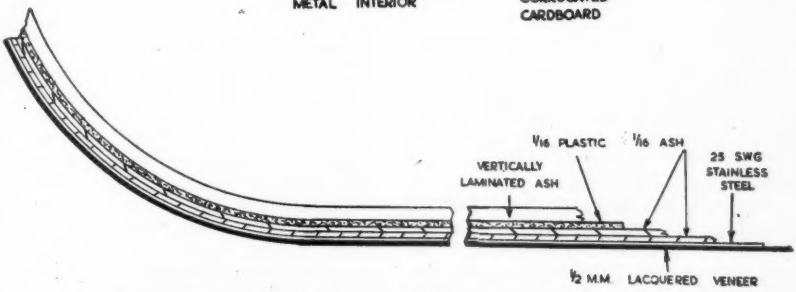


Fig. 10.—Details of laminated construction of the "Gomme" ski, made from stainless steel, phenolic sheet and ash.

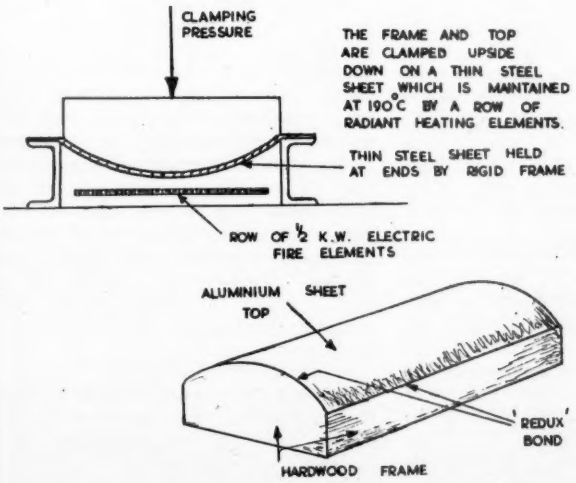

CLAMPING PRESSURE
THE FRAME AND TOP ARE CLAMPED UPSIDE DOWN ON A THIN STEEL SHEET WHICH IS MAINTAINED AT 190°C BY A ROW OF RADIANT HEATING ELEMENTS.
THIN STEEL SHEET HELD AT ENDS BY RIGID FRAME
ROW OF ½ K.W. ELECTRIC FIRE ELEMENTS
ALUMINIUM TOP SHEET
'REDUX' BOND
HARDWOOD FRAME

Fig. 11.—Jig for bonding hardwood frame to curved metal top in "Ewbank" carpet sweeper.

resulting floor has a top surface, which is not marred in any way and is none the less very strong.

The "Gomme" Ski

The use of "Redux" bonding on high-performance aircraft led Mr. Donald Gomme, of E. Gomme, Ltd., High Wycombe, to experiment with a ski made from stainless steel and ash. The results of the investigations were so good that Mr. Gomme's skis were used exclusively by the British Olympic Games team.

Fig. 10 shows the construction of the "Gomme" ski. It is of laminated construction and is comprised of the following: (1) ½-mm. lacquered-veneer running surface; (2) 25-s.w.g. stainless-steel strip (3) $\frac{1}{16}$-in. ash veneer; (4) a second $\frac{1}{16}$-in. ash veneer; (5) $\frac{1}{16}$-in. phenol-formaldehyde plastic sheet; and (6) ¾-in. laminations of ash at right angles to the flat surface of ski.

Laminations (1), (2) and (3) are bonded together in the flat by means of "Redux"; (4), (5) and (6) by a cold-setting resorcinol-formaldehyde glue, "Aerodux 185"; and the two resulting members are curved to the correct shape of the final ski and glued with a cold-setting urea-formaldehyde glue.

Because of its "sandwich" type of construction, with stainless steel and phenol-formaldehyde plastic sheets separated by wood veneers, the "Gomme" ski has a far greater torsional stiffness than a conventional one made from hardwood. As a result, it is apparently steadier on corners and, more important still, it is no less than 10 per cent. faster than any other ski.

Badminton Racquets

Samuel Fox, Ltd., of Stocksbridge, Sheffield, have now commenced production of a badminton racquet which has the great advantage that it need not be put in a press after every game. The frame of this "Silver Fox" racquet is made of stainless steel, which has to be fitted to a wooden handle.

To solve this problem, a modification of the "Redux" process has been adopted. "Redux" liquid and powder are applied to the stainless steel in the usual way and then baked in an oven at 150 degrees C. for about half an hour without the application of any pressure. The result is a metal surface which has been primed in such a way that it can be stuck to the wooden handle by means of Aerolite 300 cold-setting gap-filling wood glue, i.e., without the application of heat or pressure. The "Aerolite 300" is brushed on the prepared stainless steel and the "G.B." hardener on the wooden handle. The two parts are then lightly held together at normal temperature until the "Aerolite" urea-formaldehyde glue has set. The joint between the stainless steel and the wooden handle when made in this way is stronger than the wood.

Furniture

Visitors to the British Industries Fair may remember seeing a suite of veneered aluminium furniture exhibited by Heal and Sons, Tottenham Court Road, London, W.1, and of which a full description and photographs were published in "Plastics," March, 1947 (p. 126).

Since then a great deal of interest has been shown in making composite furniture. As in Heal's furniture, the starting point is veneered aluminium sheet made in a steam-heated plywood press at 145 degrees C. These sheets are then used to build up a sandwich material made from corrugated cardboard or from "Dufaylite," and with a very thin frame of hardwood (Fig. 9). Rounded corner pieces are made up in a similar way. Thus, the furniture is built up from these two simple elements—flat panels and corner pieces—which can be cold-glued together with very little trouble. This design gives very robust and "solid" furniture which will evidently stand up to very hard wear.

Carpet Sweepers

Entwisle and Kenyon, Ltd., of Accrington, Lancashire, who are manufacturers of the "Ewbank" carpet sweeper, have designed a very neat body for their sweeper which uses a hard wood frame "Redux"

bonded to a curved metal top. The bonding is carried out in an electrically heated jig (Fig. 11), in which heat and pressure are carefully controlled. The actual bonding takes only 2 mins., and thus a high rate of production is maintained.

The bonding of wood to metal is a new departure for adhesives, and there has been time so far to develop only a comparatively small number of applications for it. Two aspects of the technique in particular lend themselves to widespread use:—

(1) The priming of metal surfaces, which can then be glued to wood with adhesives, requires neither heat nor pressure. The whole of this procedure can be carried out with equipment already in the works of most engineering firms, i.e., an oven to bake the "Redux" liquid and powder on the metal surface. Veneered metal can, of course, be glued in a similar manner.

(2) Veneered metal sheets can now be purchased in the same way as plywood, and can be guillotined and formed on rolls in much the same manner as sheet metal.

Finally "Redux" can be used not only to glue metals to wood, but also to glue metals to metals. The process is carried out in the same way as that described above and some examples of its use include (1) the bonding of cast aluminium sinks to sheet aluminium draining boards by Rubery Owen, Ltd., Darlaston; (2) the making of aluminium window frames for the "Airoh" prefabricated house by Aluminium Window Co., Ltd., Birmingham; (3) the bonding of the all-metal Dove passenger aircraft by the de Havilland Aircraft Co., Ltd., Hatfield.

A modification of "Redux" has now been tested which permits the making of joints at either reduced temperatures or times. For example, instead of 15 mins. at 145 degrees C. being required to cure the resin, 5 mins. will be quite sufficient. If the only press available is one which will operate up to 105 degrees C., as is the case with many furniture manufacturers, then no more than 20 mins. at this temperature will be required. Tests already completed show that the modified "Redux" has all the good properties described in this article. The shorter time of "curing" required by the resin is a considerable advantage to firms engaged on large-scale production, and the alternative lower temperature (105 degrees C.) will make it possible for many firms to carry out bonding who had not hydraulic presses suitable for operation at 145 degrees C.

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An Anti-static Surface for Plastics

Many plastics pick up and hold a static electric charge on their surfaces. In addition to the disadvantageous electrical properties, the surface attracts lint and dust which is very difficult to remove, due to the strong electrical attraction. This has been overcome in the past, at least on a temporary basis, by rubbing the surfaces with various so-called anti-static agents.

The incorporation of a special synthetic wax in the moulding is now said to give excellent anti-static properties to the surfaces. For example, 1 per cent. or less of Acrawax C powder can be incorporated with a vinyl copolymer product.

Based on this discovery, many types of plastics that ordinarily pick up harmful static charges or become obscured and dirtied by lint, dust, etc., are now able to be made free from these defects. Acrawax C powder is manufactured by the Glyco Products Co., Inc., Brooklyn, N.Y. It can be used successfully on plastic sheeting and packaging films, and on parts that are rubbed, touched or moving rapidly (as on a rotating shaft).

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Cable-making Materials

Sir,—We would like to comment on the letter and your note under this heading in the April issue of "Plastics."

Pentachlorophenol is comparable in toxicity with chemicals such as benzene and phenol, which are widely used in industry with complete safety when the normal precautions are observed. Over 10 years' experience with the manufacture and application of pentachlorophenol has shown that the same holds for this chemical and its derivatives.

Pentachlorophenol is known to provide adequate protection against termites and moulds, and because of its stability is effective over long periods of time. Thus by its use timber has been preserved effectively under unusually severe natural conditions over 10 years in tests which are still in progress. Unlike copper naphthenate, which adversely affects certain important properties of natural rubber, GR-S and neoprene, pentachlorophenol has little or no effect on these properties. ("Ind. Eng. Chem.," September, 1947.)

Without further details of the particular process it is not possible to comment in detail on the problems raised, but, as we are actively investigating all uses of pentachlorophenol and its derivatives, we shall be very willing to co-operate directly with any concern interested in putting to use the proven preserving properties of this type of compound.

MONSANTO CHEMICALS, LTD.
Victoria Station House,
London, S.W.1.

Labels for Fruit Trees

Sir,—A writer in your April issue inquires if plastic labels are available for gardeners. In your comment you wish for an enterprising firm to market such a commodity. We would like to point out that this firm has gone one better: we manufacture a waterproofing solution which confers all the desired advantages on ordinary paper labels by simple dipping. The appearance of the labels is unaltered, and they are totally unaffected by water, grease or petrol. Dirt, mud or stains are simply removed by a wet rag. Furthermore, the "tooth" of the paper is preserved, so that the labels can be written on after treating. Such writing can be removed by eraser or chemical ink remover, leaving the original writing completely intact.

The invention is patented in the United States, and British and Irish patents are pending. The military rights were acquired by the United States Government in 1942. During the recent war the United States Armed Forces used 400,000,000 maps which had been waterproofed by this process, 125,000,000 being used in the invasion of Normandy alone.

The process, as used by the United States Army, was devised by Professor J. Bayley Butler, M.B.E. An account of the process is given in the "Reader's Digest," English edition, October, 1946, but no mention of Professor Bayley Butler's name is there given. The commercial rights to the process in Ireland are being operated by this company.

BIOTOX MANUFACTURING CO., LTD.
5, Dartmouth Place, Dublin.

Brush Handles

Sir,—We have followed your editorial (March) and correspondent's letter (April) on "Brush Handles" with great interest. Having specialized in the manufacture of handles, including brush backs, we feel that our observations might be of some use.

We make handles from thermosetting and thermoplastic materials, using moulding and fabricating techniques. From production experience of brush manufacturers whom we supply, we have collected the following data:—

Thermosetting materials moulded, cast or fabricated are quite suitable where

the bristles or tufts are not stapled into the handle, i.e., shaving brushes, paint brushes, hand-made wire-bound brushes, etc. They are rather hard and brittle for easy stapling, although it can be done.

Thermoplastics, moulded or fabricated, are extremely satisfactory for stapling direct into the stock, and, with minor modifications, can be handled just like timber backs. All cellulose compounds, methacrylate, polystyrene, etc., have been used by us successfully. It is a coincidence, perhaps, that we are just developing a nail brush stock from "Alkathene," which, apart from other obvious advantages, will float.

As far as other materials are concerned, we believe that we were first to use laminates, such as "Paxolin," for stocks for direct stapling. We have fabricated such stocks for an industrial application, as well as for nail brushes. Stapling by automatic high-speed machines which had worked on cellulose acetate was very satisfactory when a somewhat stiffer wire was used and the drill replaced by one of a different type.

These laminates are also very useful for industrial rotary brushes that meet with severe treatment. They are not affected by changes in temperature or moisture and, being uniform, can be balanced very easily. Where chemical resistance is of greater importance, polythene—moulded for small stocks and cast for big ones—is preferable.

Should any correspondent be interested, we will be delighted to make our experience available and co-operate in solving any particular problem.

MOULDED PRODUCTS.

Oak Park,
Tralee, Co. Kerry

Trade Mark for British Industry

Sir,—The Government is rightly anxious for greater output by those industries whose products command a ready export market. In some cases, however, it has been suggested that insufficient attention has been paid to quality.

Would it not be possible to apply an export trade mark to British industry? The product with which I am concerned, for example—namely Harris tweed—could provide a pointer for other industries. Some years ago, the Board of Trade authorized the use by our industry of the well-known trade mark consisting of an orb surmounted by a Maltese cross. This gave protection against imitations both to the islanders of the Hebrides and to the public. Not only that—it compelled the industry to maintain a high standard, because only tweed reaching this standard may bear the trade mark.

Surely this principle could with profit be more widely adopted. Trade marks should be allocated to different industries, and only goods reaching prescribed standards should be permitted to carry the trade marks.

GEORGE ELLIS, chairman,
Harris Tweed Association.

Salisbury House,
London Wall, E.C.2.

Electroplating on Plastics

SIRS,—We should be glad to know the names of electroplaters of silver, copper, etc., on plastic fancy goods.

London, N. P.C., LTD.

[EDITOR'S NOTE: We believe Rootes, Ltd., carried out a considerable amount of electroplating on plastic mouldings several years before the war.]

Sanitary Fittings in South Africa.—Union Plastics (Pty.), Ltd., Alberton, Transvaal, recently held an exhibition in Johannesburg to illustrate recent developments in South Africa, with particular emphasis on this firm's products. Union Plastics is now producing 120 wash-basins and 50 plastic sinks daily. These lines were first put into production in August, 1947, but manufacture has been so successful that apart from large sales in South Africa, a lucrative export trade was developing with Southern Rhodesia, as, owing to their lightness in weight it has become commercially profitable to send them to Rhodesia as air freight. The manufacturers have so much faith in these products that they are selling them with a five-year guarantee against breakage, warping and fading.

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

SYNCHRONOUS TIMER. — Our illustration shows one of the new synchronous timers exhibited at the Castle Bromwich section of the B.I.F. by Londex, Ltd., of 207, Anerley Road, London, S.E.20. The range of these Londex timers is being continuously improved and enlarged to meet the many

growing requirements in the field of process timing. As with relays, the tendency is for reduced size. Such timers are especially suitable for the control of moulding presses and radio frequency heating apparatus in the plastics industry.

RAW MATERIALS GUIDE.—The Board of Trade have published a revised Raw Materials Guide which sets out all the raw materials at present controlled by the Board and by the Ministry of Supply. It gives particulars of the relative statutory orders in force, together with information concerning the various changes affecting raw materials which have taken place since October, 1946. Details are also given of the types of control at present operating and the addresses at which inquiries may be made. Copies of the guide are obtainable through any bookseller or direct from H.M. Stationery Office, Kingsway, London, W.C.2, price 1s. 6d.

CIBA, LTD., have acquired a controlling interest in Aero Research, Ltd., Duxford, Cambridge, who are well known for their work on synthetic resins and for the manufacture of industrial adhesives. The continuation of technological connections, which have existed between the two companies for a considerable time, is thereby assured. It is understood that plans for the large-scale expansion of Aero Research, Ltd., have already been approved, and that both research facilities and production resources will continue to be developed under the managerial control of the company's full-time directors and shareholders, Dr. N. A. de Bruyne and Mr. R. F. G. Lea.

WELDED " PERSPEX " TUBING.—Our reference to this product in the May issue, page 259, should have given the name of the manufacturer as Evolite Plastics, Ltd.

PETROCHEMICALS, LTD. — Negotiations are approaching completion for a further £2,450,000 of finance for Petrochemicals, Ltd. By the provision of this additional finance the capacity of the Catarole " chemicals-from-oil " plant, which is now in course of completion near Manchester, will be substantially increased from that originally envisaged. It is anticipated that certain units of the plant will come into operation at the end of this year and that the entire plant will be functioning by the second half of 1949.

The Finance Corporation for Industry, Ltd., are to provide £1,450,000 of the new money, and Robert Benson, Lonsdale and Co., Ltd., will underwrite the balance. Proposals in regard to the form of the new finance will shortly be submitted to the subscribers of the original capital. No public issues of capital are at present contemplated.

In addition, part of the money provided will be used for the erection of a plant for the manufacture of styrene and polystyrene. Erinoid, Ltd., will participate in that project and will provide finance. Further details will be announced later.

MR. CYRIL S. DINGLEY, of British Industrial Plastics, Ltd., is at present on a visit to America. He hopes to be back in London early in July.

NEW ZEALAND VISITOR.—Mr. W. A. Boucher, managing director of Spedding, Ltd., Auckland, New Zealand, will be in this country about the third week in June. He

hopes to contact British manufacturers who are anxious to establish their products on the N.Z. market. Those interested should communicate with Mr. Boucher, c/o The Bank of New Zealand, Queen Victoria Street, London, E.C.4.

MR. KENNETH M. CHANCE, chairman and managing director of British Industrial Plastics, Ltd., has been appointed High Sheriff of Warwickshire. One of his first official duties was to be in attendance on Their Majesties during the royal visit to the B.I.F. at Castle Bromwich.

NEW I.C.I. DIRECTOR.—Dr. W. J. Warboys, D. Phil., has been appointed an additional director of Imperial Chemical Industries, Ltd., with effect from May 27, 1948. He will take charge of Paints, Plastics and Leathercloth Group. Hitherto chairman of I.C.I.'s Plastics Division, Dr. Warboys has been succeeded in that appointment by Mr. P. C. Allen, one of the Division's joint managing directors.

SOCIETY OF CHEMICAL INDUSTRY. The 67th annual meeting of the Society of Chemical Industry will be held in Edinburgh, July 12 to 17. The Plastics Group meeting at 9.45 a.m. on Friday, July 16, will include a lecture by Professor H. W. Melville, D.Sc., F.R.S., on "The Chemical Aspects of Elastomers." There will be a visit to the works of the North British Rubber Co., Ltd., on Friday afternoon, July 16, when the various processes of mixing, calendering, moulding, hand-making and spreading will be shown to visitors. Included among the lectures are: "Factors affecting the Strength of Paper" (S. R. H. Edge); "Review of Rosin Chemistry" (Dr. Emil Ott); "Research Developments and Applications to Textile Industries" (H. Corteen). Processes and plant for paper making will be seen during a visit to the works of Alexander Cowan and Sons, Penicuick, on Thursday, July 15.

PLASTIC INSTITUTE NOTES

New members.—Messrs. P. A. Delafield, T. W. Fazakerley, R. Neiger and J. E. Snow have been elected to Fellowship. Associateship elections include Mr. H. A. Collinson and Dr. M. G. Church.

South African Section.—The headquarters of the newly formed South African Section of the Plastics Institute is located in Johannesburg under the chairmanship of Mr. A. P. W. Hadley. Two successful meetings have already been held, and the membership is approximately 50.

Yorkshire Section.—The annual general meeting of the Yorkshire Section was held in Leeds on April 28 under the chairmanship of Mr. C. R. Williams, F.P.I., who was re-elected for the coming year. Mr. F. Cass was also re-elected as hon. secretary. The meeting was fortunate in having the attendance of the President of the Institute, the Chairman of Council, the Chairman of London Section, and the Managing Secretary.

North-East Section.—The annual general meeting of the N.E. Section was held in Newcastle on May 18 when Mr. W. A. Cook was re-elected chairman for the coming year. Mr. H. Barker was also re-elected as hon. secretary. The meeting was followed by a dinner and a successful social evening.

Monographs.—Recent additions to the series of Plastic Monographs issued for educational purposes by the Plastics Institute include: No. 6, "Ethenoid Plastics," by R. G. Heyes. No. 15, "Synthetic Resins in the Paint and Varnish Industry," by S. R. W. Martin.

NOTES FROM THE BRITISH PLASTICS FEDERATION

New Members

PLASTICS MATERIAL MANUFACTURERS GROUP: Welwyn Plastics, Ltd.

MOULDERS GROUP: Richglaze Plastics, Ltd.

Worshipful Company of Horners Awards

Eleven entries of a high standard have been received for these awards.

Bowen Prize Fund

The latest date for entries for this Prize has been extended to June 30.

Fabricators Group

A very successful luncheon meeting was recently held by the Fabricators Group at the Café Royal, London.

Moulding Powder Imports

Imports of moulding powders during quarter ended March 31, 1948, were as follows:—

	Jan. (tons)	Feb. (tons)	Mar. (tons)	Total (tons)
Phenolic ...	509	341	498	1,348
Urea ...	73	14	71	158
Polystyrene ...	—	50	—	50
Cellulose acetate-butyrate	—	3	—	3

British Industries Fair

Over 700 inquiries were received at the Federation stand; this was considerably fewer than in 1947, but a much larger percentage of these inquiries appeared to be of a quality higher than was the case last year.

Quality Control in Plastic Moulding—VII

By W. M. HALLIDAY

Here the author discusses in further detail the necessary procedures and inspection methods to be adopted when instituting quality control for productions from various types of injection plastics moulds. Particular emphasis is given to the important questions of correct component gauging methods and equipment to suit quality control of output. The requirements for control charts are also considered, dealing with the production of moulded components having several critical dimensions to be kept within close limits of variation.

IT will be recalled that particular attention was devoted in the previous instalment to the explanation of the numerous essential points of difference between compression and injection moulding practices, in so far as such differences are likely to affect the application of quality control procedures. Brief intimation was also made of some of the probable and desirable modifications required to the simple types of quality control methods and procedures so far considered throughout the preceding sections, in order that these may be the more suitably adapted for application to semi or fully automatic forms of injection moulding.

These essential points of departure between the two distinctive methods of moulding, by which the injection process is characterized by high-speed production, greater intricacy of moulding tools, closer dimensional accuracy in respect of the moulded part, and so forth, will entail important modifications to the checking and gauging methods hitherto employed with familiar customary types of component inspection. It is the purpose of this present article still further to consider the nature, extent and effects of such modifications.

Inspection methods and policies on the moulding shop floor vary very considerably from factory to factory, and they are often to a large extent determined not so much by the actual needs of the component being produced, as by an unduly conservative or restricted conventional outlook on the part of the moulding shop inspector. Such an outlook is very apt to lead to a continued application of component inspection and gauging methods, and gauging equipment based upon no better reasons than that such methods and equipment are readily available and, moreover, have always been employed in the past, or have always been found adequate for conventional forms of gauging.

Where there is such an unduly rigid adherence to customary ways of gauging, coupled with a resistance or unwillingness to consider changes of either methods or equipment, inauguration of quality control methods will be additionally difficult and, moreover, when such attempts are made, will be likely to be associated with numerous snags and difficulties.

Some large moulding concerns conduct their inspection activities along these undesirable lines, but generally the practice tends to be confined to the small works where conventional methods of inspection are apt to be too rigidly enforced, for the following understandable reasons. The small concern is usually not as well placed as the larger firm to conduct experiments, or to obtain costly improved gauging appliances, on account of the large capital outlay which may sometimes be involved.

This question of suitable gauging tools for injection mouldings being quality controlled is, indeed, the first important point we have to consider before the correct form of quality control procedure can be evolved.

With most kinds of injection moulded articles, usually one or more dimensions

have to be maintained within closer limits of variation than is possible with compression mouldings. With the latter process of plastic moulding, as is well known, by its very nature there are a number of variable factors which are difficult to stabilize, especially throughout long production runs, and therefore the moulded components cannot be held to the same close degree of size tolerance as with injection mouldings.

Successful Control Depends Upon Sound Gauging Methods

When considering applying quality control procedures to the bulk production of injection mouldings of the precision kind just mentioned, it will at once be obvious that the success of the quality control scheme must depend primarily upon the nature of the gauging system and the actual tools and gauges employed.

Where such gauges and methods are unsuitable or unsatisfactory, the measuring and checking of the various critical dimensions on the produced components will be unreliable.

This point is strongly stressed at this stage of the discussion, because all too often the present writer has found that quality control methods have been introduced to an injection moulding production operation, sometimes with great enthusiasm and keenness, only to find after a short time that very unsatisfactory results have been obtained, which upon closer examination were found to be due mainly to use of unsuitable types of gauging or measuring tools for the checking of the component.

At the outset of this study, therefore, it is very essential to be perfectly clear as to the best kinds of gauges and measuring tools to employ, and also what is equally as important, the limitations possessed by the conventional and familiar types of such equipment, now largely used for injection moulding inspection purposes.

Deciding Which Dimensions Should be Quality Controlled

With such injection mouldings having several critical dimensions to be held within fine limits of accuracy, before any attempt is made to inaugurate quality control, it will first be necessary to decide which dimensions are to be given preference as far as gauging and charting are concerned when the quality control methods are in operation.

It might prove adequate and convenient to decide that tolerances beyond specific values are too coarse to render quality control of them necessary. Thus dimensions on which the permissible tolerance or error is, say, plus or minus .004 in. may be adequately and safely kept under control by simple orthodox checking by means of the micrometer or the widely used "go" and "not-go" type snap or plug gauges which are customarily employed for testing the sizes of external or internal dimensions. Such gauging would, of course, be performed at more or less regular intervals, the frequency of which would be determined chiefly by the rate of output from the mould and the relative importance of the dimension.

In actual injection moulding practice only occasionally will it arise that the proposed moulded article must be held to close tolerances (say, of an order finer than plus or minus .003 in.) on more than four or five critical dimensions. This being so, it is fortunately relatively simple to provide composite types of control charts capable of being easily compiled so as to record quite plainly the variation trends of such a small number of critical dimensions.

In the previous articles on this subject explanations were given to illustrate one simple method of control chart construction and usage when several features, not necessarily dimensional ones, were required to be held within specified limits. As will be recalled, this method was adopted in connection with a simple hand-operated compression moulding tool, the products from which had to be maintained within stipulated limits of size variation, weight and quality of surface finish.

The method just described consisted of obtaining average values of the degree of variation taking place with respect

of each feature and employing a single graph chart for plotting the production tendencies towards variation. Thus by this method it will have been understood a single plotted point was made to represent dimensional variations, weight deviations and those of surface finish.

Such a method as this would prove quite satisfactory in regard to moulded components where only one of the critical features was a dimension; but in the case of an article having three or four dimensional features, as distinct from weight and surface finish, it will be advisable to adopt a somewhat different method.

To meet the rather more stringent requirements of the kind just envisaged, it would be necessary to construct a control chart having a graph diagram for each of the critical dimensions to be controlled; at a later point specimen charts will be given to illustrate their construction and application to such circumstances for the better guidance of the readers.

Incidentally it will be found in practice that a four- or five-graph composite control chart will be about the limit desirable in graph compilation. Any additional number of graph diagrams contained on a single control chart will undoubtedly lead to some confusion as well as entailing a disproportionate amount of time in their compilation and evaluation.

It is vital that the control chart for any particular quality control application be kept as simple, direct and unambiguous as possible, an end which usually can be readily secured by maintaining the number of graph diagrams on a single chart as low as possible. In the rare event of a moulded component having more than five dimensions to be held within critical limits, then the wisest policy would be to employ two separate and distinct charts, in order to retain clarity of presentation, and simpler filling-up of the chart. Another advantage gained from this practice would be to render the charts covering the job in question more plainly decipherable to supervisors and others directly interested when passing to and fro through the moulding shop.

Limitation of Customary "Go" and "Not-Go" Gauges

Before proceeding to the study of such composite charts and how they are constructed and used, it is necessary to return for a short space to the question of customary gauging practice employing "go" and "not-go" kinds of gauges, in order to discover the degree of applicability for such a method to quality control, and to observe certain serious limitations, intimation of which was given earlier in this article.

The chief and most obvious drawbacks of the familiar and widely used "go" and "not-go" gauge for either internal or external measurements are the lack of precision, and absence of direct reading. To illustrate this better, let us take an actual example.

If the tolerance between the "go" and "not-go" portions of the gauge is, say, .004 in. it will be possible for a component, having been checked, to conform to the tolerances provided by the gauge, and yet leave an inspector unable to determine by how much the part is plus or minus the nominal measurement specified.

Thus, with such an example, it will be possible for the component to be in conformity with the gauge and yet be as much as plus .002 in. above or below the nominal dimension.

If quality control is to be successfully applied it is necessary for the inspector or checker to know exactly by how much the measured component differs in either the plus or minus direction from the average size required.

From what has already been written upon quality control charting requirements, it will be obvious that precise measurements must always be taken of the sample components selected as representative of the production during a run of any pre-determined period. Three very important requirements, therefore, must be satisfied to meet the purpose of quality control. They are :—

(1) The measurement taken by a gauge must possess an exact numerical value, which can be directly and accurately measured.

(2) It must be readily derivable without the use of unduly elaborate equipment likely to occupy an excessive length of time.

(3) The measurement should be visual in character, preferably.

These three considerations be it noted determine very powerfully the design features for all checking and gauging equipment to be employed in conjunction with a system of quality control.

Before leaving this important subject perhaps it will be advisable to illustrate the manner in which gauge design for quality control is thus affected by the above factors. Most types of conventional gauging and measuring appliances fall within one of two classes. Some tools are direct reading, others are not.

The vernier calliper gauge, or micrometer, are very commonly used for checking dimensions on moulded components. Their setting and use may involve a considerable time, especially if one has to explain and to instruct an operator as to the principles of their correct use. In contrast to these tools, it is comparatively simple to instruct an operator how to read the dials of a comparator gauge. Both types of instrument are visual, but the latter is direct reading, whilst the micrometer and calliper gauge are not.

Moreover, by all three types of gauges an exact measurement of the particular dimension is obtained, which is essential when checking dimensional variations under a system of quality control. As a general rule, therefore, those designs of gauging appliances should be selected for use in conjunction with quality control methods, which will permit visual, direct reading of the dimension of a component.

Those gauges possessing a highly sensitive indication of a relative numerical value, such as are particularly associated with dial recording instruments of the kind just mentioned, will be found to provide the most successful, easy-operating and accurate results on the factory floor under a scheme of quality control. Without gauges of this character the methods of quality control can only be carried out with considerable difficulty, error and unreliability.

With most kinds of injection mouldings it will easily be possible to arrange a number of dial indicating gauges each one of which would have been previously set to the correct point. Such indicator gauges would be mounted upon a suitable stand and so arranged that the admission of a component to each gauge is a straightforward matter.

Of course, such an arrangement presupposes a complete set of master checking plugs, by reference to which each dial gauge would be initially set to its proper reading. Also by means of these masters periodical checkings could be made during the progress of production to ensure adherence of the gauges to their original setting.

The essential feature of such a method of gauging is, of course, that a visual reading of a component dimension is rapidly effected, and, in addition, the user of the gauge is afforded a direct numerical value, denoting whether the part being checked is below or above the nominal size, and by how much.

As to the method of employing such an arrangement of dial gauges, the writer would recommend that the task of checking the setting of the gauges be allotted to the chief inspector, who would undertake to make regular visits to each inspection table to test these settings. The master setting plugs or blocks, as the case may be, would be retained by him for safe keeping, and should never be left lying around in the moulding shop, or on the inspection stand.

Bearing in mind these chief essentials, production moulders should experience no difficulty in devising direct, visual indicating gauging apparatus of the kind just described, adapted to suit a particular gauging problem, and it is hoped enough has been discussed to serve as a guide for those injection moulders wishing to institute quality control methods.

Importance of Proper Inspection Methods

Not only is it essential that suitable visual and direct-reading types of gauges

or measuring instruments, of the kind just described, be employed in conjunction with quality control of injection mouldings, but the methods of their application and use must also be suitably adapted to secure the best working conditions. It will be clearly appreciated that even though accurate and reliable gauges are employed, any wrongful usage, or lack of care in using them, will produce results which will very seriously detract from the reliability of the entire scheme of quality control.

Unfortunately, even with quality control methods it is not possible entirely to eliminate the " human element." Individuals will still have to be relied upon to perform the actual measuring or gauging of components as they are produced, and for transferring such information to the control charts provided.

The correct performance of these operations so vital to the successful running of the inspection scheme, therefore, depends upon the degree of care, interest and zeal displayed by the checker, inspector, mould operator and setter. Unless all the operations of component measuring and data recording on the charts are performed with absolute reliability and close accuracy, very serious discrepancies, errors and faults may arise. Some of these, in the form of defective components, may leak through subsequent operations, giving rise to trouble in a number of ways.

For example, a production run may be characterized by considerable quantities of defective parts, the correction of which may involve a great deal of trouble and additional expense not normally budgeted for in the estimates covering the job. Thus an actual loss may result. Worse still, such defective components may have become mixed with perfectly sound mouldings, and so be delivered inadvertently to the client, again giving rise to dissatisfaction to all concerned.

Delays may also be occasioned due to interruptions in the production flow in order to conduct 100 per cent. investigations and checking of large batches of parts to locate the exact scale of the suspected faulty parts. Moulders engaged directly on the production of such mouldings may also be caused to suffer financial loss of either output bonus or piece-rate earnings due to failure to detect or record the correct size of parts.

Therefore, to avoid these and other undesirable features, it is essential that the greatest care be taken by the checker when measuring up sample components at each inspection visit to the injection machine. Accurate results should be obtained, and, furthermore, all entries based upon those measurements which have to be made on the requisite control charts, must be similarly performed with care and correctness.

It is also equally important to the successful application of quality control to injection-moulding processes, that, in the event of the production passing out of control, none of the mouldings produced since the preceding inspection check should be mixed with those of previous checkings which are known to be correct.

Such "suspect" components would, of course, be demonstrated as doubtful by the plottings of the control chart, and therefore should be rigorously segregated from other mouldings in order to facilitate a separate 100 per cent. check of every component in the suspected batch.

Decisions as to whether only a percentage or total inspection check is required for such known doubtful workpieces, will depend upon the extent of the departure from true control, again as depicted by the positions of the plotted points on the control graph. As explained in an earlier section of this series of articles, the closer proximity the plotted points bear to the datums of the drawing tolerances on the control graph, the greater probability there is that actual defectives or scrap has been produced.

The usual procedure in the event of a loss of control occurring during a production run, is for the inspector detecting such a tendency to notify the mould operator and setter immediately such a trend becomes markedly evident, and before it has reached serious proportions.

This can readily be determined, provided the control chart is correctly compiled and watched with due care.

Often when a departure from control has thus been discerned at its early stages, production from the mould need not be stopped, because generally only a minor readjustment to some mould member will be required to restore control. In the case of a serious departure, however, the inspector should lose no time in stopping the working of the mould, and advising both the mould operator and the setter of the circumstances.

This is an extremely important point in quality control methods, and obviously from its successful observance considerable reliance has to be placed upon the discretion, initiative, and judgment of the inspector so as to ensure that prompt action is always taken once the plotted points on the control chart approach too dangerously close to the datums representing the drawing tolerances.

These are only some of the chief points in respect of inspection methods which demand the close interest and attention of inspectors, as well as co-operation between them and the mould setters. There are, of course, a number of other similar but lesser important points associated with each injection mould used, to which due consideration will have to be given, but the above will serve to indicate the general features which must be attained to ensure the creation of that desirable degree of reliance, personal integrity and honesty demanded of the quality control inspector.

Reasons for Loss of Control in Injection Mouldings

From what has already been discussed it will also be clearly appreciated that it is not vitally essential that quality control inspectors and operators on the moulding-shop floor shall know minutely all the statistical principles and reasons underlying the system. Likewise, it is not absolutely necessary for them to know the why and wherefore, or reasons, of any particular departure from control which might arise during production.

Providing the inspection staff are sufficiently acquainted with the requirements of the plotting of data on the charts and are able to interpret and understand the trends revealed by such plottings, they can quite satisfactorily check the control of any moulding job in progress.

On the other hand, in view of what has already been mentioned about the need for care and scrupulous attention in both checking and recording, it will undoubtedly assist towards promoting such interest if some knowledge of the basic statistical principles is possessed by these individuals.

In addition to this, it will prove specially helpful towards creating and maintaining greater interest if inspectors, checkers and moulders acquire some understanding of the causes of loss of control which can occur in respect of injection mouldings. Not only will such knowledge serve to provide a generally increased interest in the complete inspection system, so materially assisting towards its more successful operation, but it will also lead to a more rapid detection of those mould or moulding machine faults or inadequacies which give rise to the loss of control over the injection mouldings themselves.

To serve as a guide to this end, the author lists here some of the more common and familiar causes of dimensional variations and the formation of other undesirable features in connection with injection-moulded products. As will be noticed, these causes are mainly associated with the moulding tools and the machine. The list, however, must not be regarded as exhaustive, since little mention is made of the troubles arising as an outcome of lapses on the part of the machine operator. It is felt, however, that these will be sufficiently well known and readily detected not to require special mention here.

DISCREPANCIES ARISING FROM DEFECTS IN MOULDS

(a) Wear or bruises of cores or core guide holes.

(b) Bending of slender cores.

(c) Endwise or radial displacement of core pins.

(d) Wear of cavity wall surfaces.

(e) Distortion, wear or misplacement of dowels.

(f) Distortion of parting-line surfaces of mould blocks.

(g) Presence of waste material or bruises on the parting-line surfaces of the blocks.

(h) Misalignment of mould blocks from any other cause.

(i) Wear or damage to reamers, gates or sprue channel.

(j) Faults in ejector pins, guide holes and any defects leading to delayed or stiffened or improper ejection of the finished mouldings.

(k) Overheating of mould blocks, leading to their excessive expansion.

(l) Improper mounting of mould blocks on machine platens.

(m) Inadequate or excessive water cooling, causing too wide variations in mould temperature.

Practically all these mould faults will lead to variations in some of the dimensions on the moulded product, and in the sizes of a precision type injection-moulding defects will often be found to arise from one or more of the above causes.

ERRORS ARISING AS A RESULT OF INJECTION MACHINE FAULTS

(n) Wear between platens and guide bars, allowing undue slackness of the former.

(o) Loss of injecting pressure.

(p) Failure of heating elements.

(q) Misalignment of platens from any cause.

(r) Insufficient mould-block closure clamping pressure.

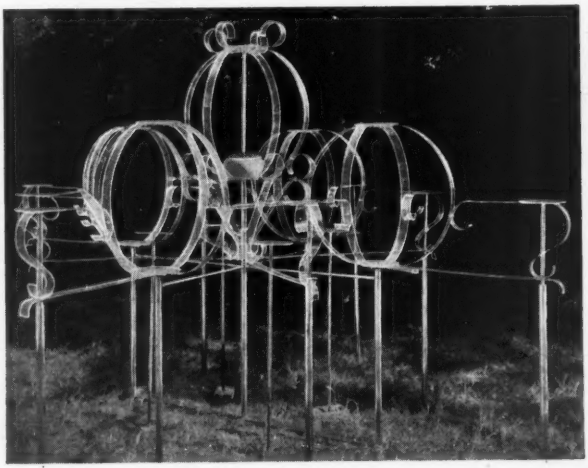
(s) Distortion of guide bars.

(t) Damage or inaccuracies of the mating surfaces of the platens, thus causing bad sealing of mould blocks.

(u) Damage to, or faulty sealing of, nozzle on mould-block seating.

Some of these undesirable features may cause poor surface finish, or loss of weight, or weakness, or incorrect sizing, or a distorted and dimensionally inaccurate moulding. Usually, determination of some of the injection-machine faults may lie outside the responsibility of a machine operator or a mould setter, but it will often greatly assist in more quickly locating the cause of a faulty or inaccurate moulding if an inspector is aware of such cause-and-effect features as listed above.

(To be continued)



This stand, fabricated from strips of "Perspex," suitably curved and jointed, and supported by chromium-plated rods, was used as a central feature for the display of about 12,000 spikes of sweet peas, at the stand of Carters Tested Seeds, Ltd., at the Chelsea Flower Show. The stand was constructed by Clear Glass Products, Ltd., of Southampton. The delicate colours of the flowers were set off to perfection by the transparency of the "Perspex."

The Microscopic Examination of Plastic Materials

VII.—Mouldings (Contd.)

By J. H. WREDDEN, F.R.M.S.
(Chief Chemist, Igranic Electric Co., Ltd.)

HAVING seen that resin masses in the beechwood-filled moulding show a granulated appearance, it is desirable to examine this structure somewhat more closely, so that we may ascertain whether or not it is due to the presence of bubbles. Before doing this, however, it would perhaps be as well to point out that during the examination of laminated materials, the presence of large numbers of minute bubbles in the resin masses was established and therefore some such condition may be expected to exist in a moulding.

That this is the case is seen when the section is examined at higher magnifications than hitherto used. Thus a portion of a particle is seen in Fig. 297 at a magnification of 515 diameters. Here, a fairly large vessel is shown, the walls being indicated at A and B. The vessel is filled with resin and the structure of this latter exhibits some interesting characteristics which are worth discussion. For example, the resin mass in general indicated at C is already seen to be very granular, and, although they are very small at this magnification, the presence of bubbles is definite. However, in addition to these it will be noticed that the vessel contains a chain of much larger bubbles, four of which are indicated at the points D, E, F and G. These bubbles are very interesting as they present an appearance very similar to those encountered in the interstices of the yarn in the fabric used in varnished shavings, but the processing conditions in the two cases are somewhat different and therefore the method of origin of the bubbles under discussion may be regarded as being different. Apart from this it is not a simple matter to arrive at any conclusion regarding their nature and origin.

In the first instance the minute bubbles in the resin matrix may be presumed to be those due to the reaction water which cannot escape owing to moulding pressure, followed by the immobilizing of the resin due to the near completion of the cross-linking in the system. This leads to speculation as to a possible cause of the difference existing between the theoretical strength of the resin and that encountered in practice. This difference is well known to be of considerable magnitude and can be partly accounted for by assuming incomplete cross-linking, but it is doubtful whether this can account for the whole of the discrepancy. Therefore it becomes evident that the presence of these minute bubbles must also exert an influence in this direction, for the resultant structure is honeycombed with

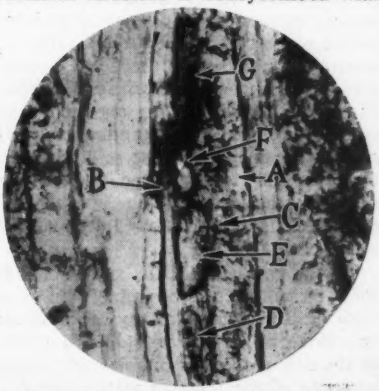


Fig. 297.—Section of beechwood-filled moulding showing chain of bubbles in vessel. Mag. 515 diameters.

these voids, in consequence of which a great deal of the mechanical strength is lost. In addition to this, it is also probable that the actual presence of the water, as it is cut off, acts in some measure in an inhibitory manner, tending to retard the cross-linking, thus bringing about a further degree of incompleteness of cure.

From the point of view of the ultimate strength of the moulding, these bubbles will be seen to be an undesirable factor; the presence of the chain of bubbles in this vessel is even more undesirable, as owing to their size the weakening effect on the general structure is much greater owing to its being localized in nature. The mechanism which operates to bring about this curious arrangement is not exactly clear. It is possible that it originated as an air pocket situated at the end of the vessel, and that under the influence of the pressure of the liquid resin, and probably also to that due to its own expansion under elevated temperature, the mass of air was broken up into a series of smaller bubbles which were either carried, or forced, into the tubular vessel by the resin.

In this way a series of bubbles would be formed in the resin mass in the vessel, arranged very much in the manner shown. If this be the case, then the mass filling the vessel contains resin and its associated moisture situated in the minute bubbles and an appreciable volume of air enclosed in the large chain of bubbles. This, in general, is not exactly the desired structure of the ideal concept wherein the filler particles would be impregnated and sounded by the solid, continuous resin matrix, for in this case the result appears to take the form of the one cellular material—the filler—being impregnated and embedded in another cellular material —the resin and bubbles.

It will be seen that the conditions, as they exist, are not desirable, but it is difficult to see how any appreciable improvement may be brought about; for, in the first place, the bubbles due to the presence of the reaction water occupy a volume of the whole which is by no means inconsiderable. This will be

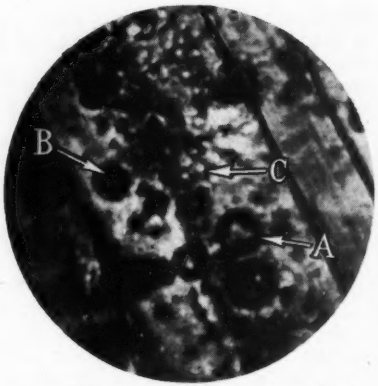


Fig. 298.—Section of beechwood-filled moulding showing mass of small bubbles. Mag. 1,000 diameters.

clarified to some extent by reference to Fig. 298, which shows a portion of the resin mass at 1,000 diameters. From this it is clear that the bubbles occupy a considerable proportion of the mass filling the vessel, indeed, this may be as high as 15 per cent. of the total volume.

An interesting feature of these bubbles is their difference in size, for it will be noticed that they may be roughly divided, according to size, into three main groups, the largest being those seen at A, the medium sized at B, and the smallest at C. In this instance, again owing to the paucity of available information, the reason for these differing sizes is not quite clear, although it might be assumed that one of the probable causes is that the largest bubbles are the first to be formed; in other words, they are originated by the first of the reaction water to come off. As a result of this we must not overlook the fact that the water will inevitably take into solution a proportion of the water soluble constituents of the resin, which are present at this stage, and hence it is probable that these, together with the water, constitute the contents of the bubble.

As the reaction proceeds and the resin becomes less mobile, the bubbles formed will, obviously, be smaller until the time is reached when the resin sets and

becomes quite immobile. When looked at from this aspect the presence of the various sizes of bubble is not really surprising, but it should be borne in mind that they are of extremely small size, in spite of which the cumulative effect of large numbers will be appreciated. Their size, however, is capable of variation according to the moulding conditions, i.e., temperature, time and pressure, and the nature of the resin used. In Fig. 298 the largest bubbles are in reality only about 65μ in diameter, or 0.0025 inch, while the medium-sized bubbles are about 42μ, or 0.0017 inch. The smallest bubbles are a mere 8.0μ in diameter, which shows them to be very small indeed.

The point of greatest significance, however, lies in the fact of their great prolificacy as compared to that of the two larger sizes of bubble. This would seem to be in the nature of a measure of support to the assumption that the size of bubble is partly dependant upon the time at which it was formed after the reaction commenced. Thus the profuse small bubbles are formed when the reaction is at its maximum velocity and nearing the setting point. The size of these bubbles will also be dictated, in part, by the initial viscosity of the resin, so that with a material of low viscosity one would expect more and larger bubbles of the maximum size, with a greater number of grades of sizes down to the smallest, owing to the resin remaining mobile for a longer period than would be the case with a resin of high viscosity.

From the foregoing it would appear that, in the absence of information to the contrary, the resin matrix in a moulding such as this is anything but an homogeneous body, owing to the presence of a relatively high percentage of voids, and in considering the structure as a whole it must be classed as being somewhat undesirable and open to improvement. However, the presence of these bubbles is of some slight value in one respect, inasmuch as they enable the investigator to establish the degree of impregnation of a particular particle.

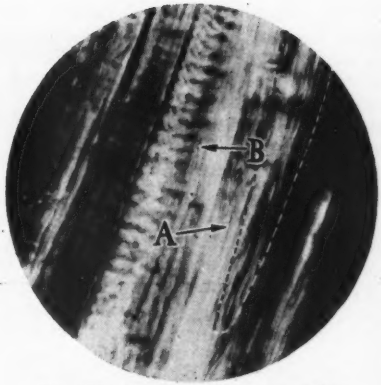


Fig. 299.—Beechwood-filled moulding showing unimpregnated particle. Mag 1,000 diameters.

In Fig 299 we see one of the beechwood particles at a magnification of 1,000 diameters. It will be seen from this that there is no resin in the vessels of this unit, which are seen in longitudinal section, in consequence of which the structure of the wood is much more easily distinguished and possible identification facilitated. At A we see outlined a portion of a medullary ray, which, of course, signifies the section to be tangential. At the point B the presence of spirally thickened vessels is clearly indicated, thus ensuring the knowledge that the wood is deciduous, or hardwood. This information, taken together with that obtained as a result of examination of the rest of the section, would be enough to establish the identity of a hardwood filler, but insufficient to identify the species of wood if this were not known beforehand. In point of fact, the absence of typical softwood structures in the filler particles of this moulding would be sufficient if vessels such as these were not found in the section.

This beechwood-filled moulding offered a very different picture from that shown by the flax-shive-filled material. In general, the filler has a small variability index, in consequence of which the formation of channels and turbulence effects were very much less pronounced.

It must not, however, be assumed that the large V.I. is the sole cause of these effects in the shive-filled material, as the particle shape will also have an influence on this phenomenon, inasmuch as the shape of the shive particle, particularly in transverse section, is very much more regular than that of the beech-wood flour particle.

Apart from this there was a striking difference between the two sections in so far as the appearance and visibility of the filler particles are concerned. The shive particles were very clear-cut and sharply defined, whereas the beech particles were much more difficult to distinguish, and, incidentally, to photograph. This effect would appear to be due to the lack of impregnation in the shive particle, causing it to stand out against its background. The beech particles, on the other hand, were much more completely impregnated, as we have seen, with the result that the refractive index of the combination was more continuous and the filler particles tended to become invisible in its surroundings. This is also one of the reasons why very little of the known wood structure was able to be clearly distinguished. However, the fact that a well-impregnated particle is more difficult to see than one which is not is a good indication of the extent of this latter, and, as we shall see, the better the impregnation, the less easy is the filler seen as a separate and distinct entity in the structure.

In view of this, let us proceed one step farther in this examination of mouldings to one filled with oak flour. This wood is rich in tannins and therefore it is expedient to study the moulding with this in mind. In order to do so it would not be remiss to discuss briefly the nature of tannins in general and their probable effect when incorporated into a moulding powder in particular. The generic term applies to a large number of different substances found in the cell sap of many plants. They are condensation products of certain acids which are phenolic in nature.

In considering a few examples we find that substances like benzoic acid, although not present in plant tissues as such, may be obtained by breaking down the plant resin, gum benzoin, in much the same manner. Protocatechuic acid and gallic acid may be obtained. Thus it is evident that these and other aromatic acids are like monomeric units from which the complex tannins are built up. The tannin present in oak is gallotannic acid, a derivative of pyrogallol. Other tannins are apparently derived from catechol, these being called phlobotannins, in order to distinguish them from the pyrogallol tannins. From this it will be seen that tannins are phenolic bodies containing a relatively high percentage of active phenolic groupings and in view of this, and also the fact that appreciable quantities are present in oak wood, it is rather to be expected than otherwise that they will take part in the resin reaction to some extent.

This being so, it is reasonable to suppose that the bond between the particle surface and the resin matrix would be more of a chemical nature in this case than previously encountered, and the investment of the particles concerned should be very much more intimate, as a result of which their visibility should be correspondingly decreased. On examining a section of an oak-filled moulding, we are presented

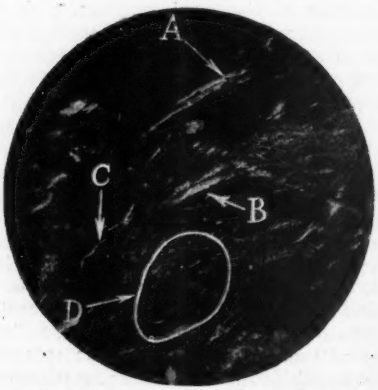
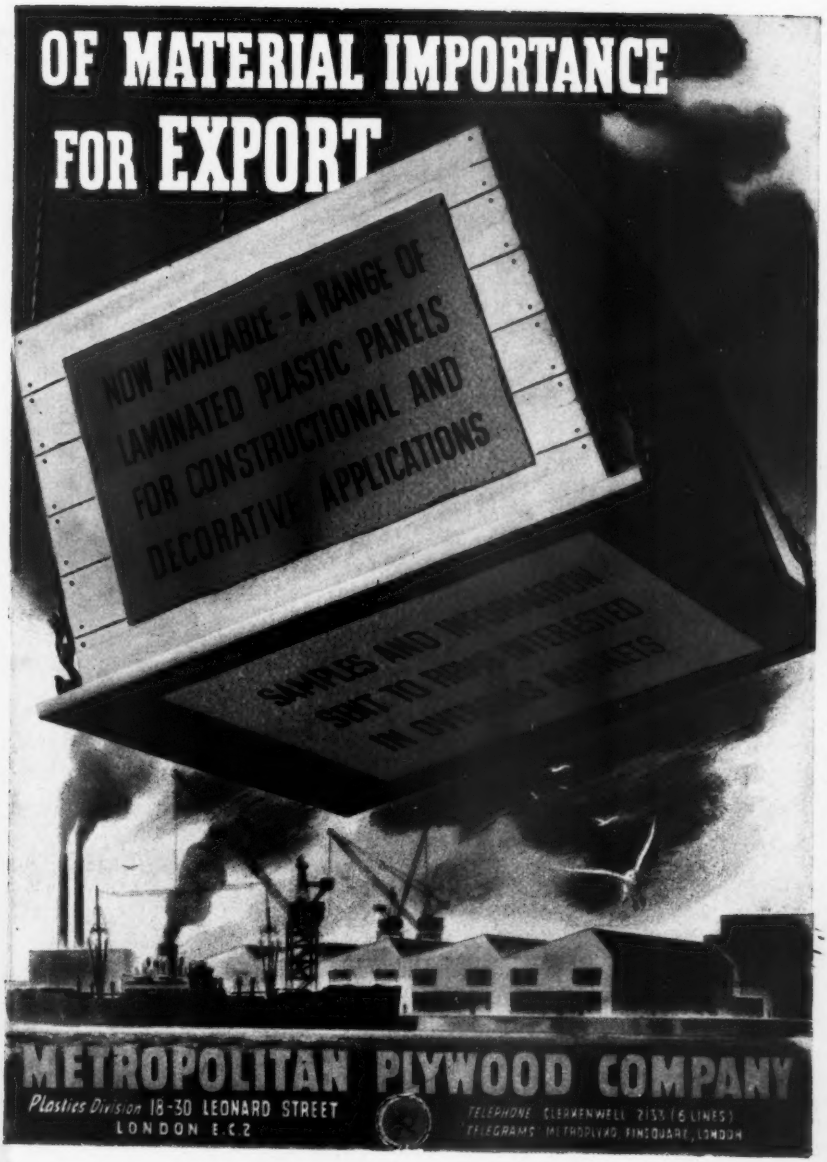


Fig. 300.—General structure of oak-filled moulding. Mag. 40 diameters.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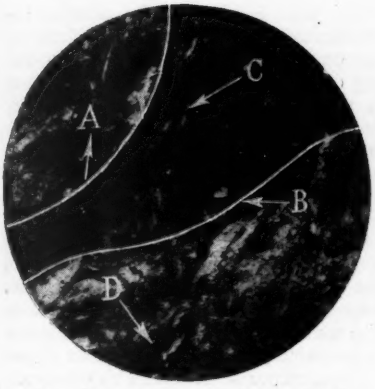

Fig. 301.—Section of oak-filled moulding showing segregation channel. Mag. 50 diameters.

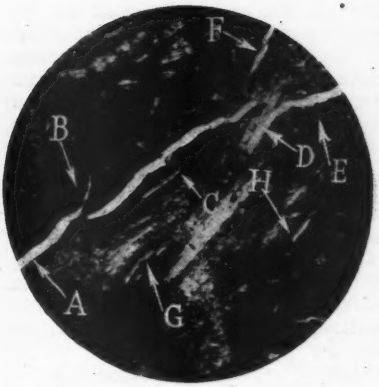

Fig. 302.—Section of oak-filled moulding showing crack. Mag. 50 diameters.

with a structure bearing many points of difference from those seen hitherto. Such a section is seen in Fig. 300 at a magnification of 40 diameters; again, in this case, the section was taken from the same locality of the tensile test piece, as for the two previous examples.

The most outstanding feature of this illustration, when compared with the others, is the absence of a sharply delineated and clear-cut structure. The individual particles are difficult to distinguish and the whole mass presents the appearance of being more homogeneous than those previously examined. However, some of the larger particles are light in colour and are comparatively easy to pick out; from the presence of these it will be noticed that there again appears to be a strong tendency towards horizontal orientation, as evidenced by the relative positions of particles marked A and B, which make clear the general tendency for all the particles to so position themselves.

Apart from these, there will be seen numerous particles either very dark or black in colour, such as that marked C, and the group I. These occur in large numbers throughout the section, and a curious feature is the presence of a crack in the centre of the majority of these units. This phenomenon is obviously a most undesirable characteristic since it points to each of these particles as being a weak spot in the structure as a whole.

This aspect will, however, be discussed in greater detail subsequently; for the moment it is expedient to continue with the examination of other portions of the section. One such portion is seen in Fig. 301, at a magnification of 50 diameters. From this illustration it will be seen that the tendency for orientation is more strongly marked and at the same time a new effect becomes apparent, in that there also appears to be a tendency towards segregation of particles. Evidence exists in this portion of the section pointing to channel formation, but not in quite the same manner as previously noted, for in the other cases channels were apparently formed as a result of single large particles becoming immobile at a comparatively early stage in the proceedings.

In the case under discussion the channel appears to have developed as a result of groups of particles, A and B, of relatively large size and different in nature from those in the channel, becoming immobilized sooner than the dark particles in the channel. It will be seen that the great majority of these particles are of the latter type and as such are, of course, smaller than those composing the majority of segregated groups on either

side.' It will again be noticed how the greater portion of the dark particles seen in this illustration possess the central crack. This crack is a definite rupture of the material at these points and extends through the thickness of the section. Good examples of this are illustrated at C and D.

The appearance of these cracks leads to some interesting speculation as to their cause and possible effects with regard to this latter. If reference is made to Fig. 300 it will be seen that at the point marked C there are two dark particles possessing central cracks, so aligned that they are placed end to end. In this manner it can be appreciated how the crack in one particle can quite easily extend into and link up with the crack in the other; thus, if a series of these particles were so placed, there would exist in the structure a potentially large crack. Also it will be seen that a large crack could be developed along a line of such particles placed at intervals, such as that shown in Fig. 302, illustrating a crack of this nature at a magnification of 50 diameters. Examination of this fracture shows that along its course there are several of these particles. At A the remnants of one are seen on either side of the gap, while at B another particle is responsible for the development of a branch. At C, however, we see a large specimen still exhibiting its central crack, and with the main line of the rupture passing through one side, in this case it is highly probable that the particle originally showed two cracks in its structure.

Further along we come to an interesting point where one of the lighter, or woody, particles lies across the path of the crack and here the crack is discontinuous. The woody particle has all too clearly possessed sufficient strength to withstand the disruptive forces and still remains in position, bridging the gap. However, immediately behind this unit is another of the dark particles with the rupture passing through it. At the same time near the formation of a second branch, due to the presence of particle E, will be noted the presence of the two other units G and H. In general, this photograph illustrates an interesting development in the structure of this moulding filled with oak flour, and has served to show that the presence of these dark particles, although they are part of the wood structure, are not exactly desirable constituents. Their effect is so great, however, that it necessitates closer examination in order to elucidate the problem a little further.

The question now centres on the reason for their dark colour. All the factors leading to the development of this colour are not by any means elucidated, but it is probable that one of the main causes is the presence of tannin. This substance, as we have seen, is present in the cell sap in the living portion of the tree, in the colloidal solution; but in the xylem tissue it has been detected in solid form in association with the cell walls, particularly in those vessels possessing heavily thickened walls. Thus it will be seen that the tannin is in an active form and readily available.

In view of this it is desirable to examine a dark particle at high magnification; one such is seen in Fig. 303 at 500 diameters. It will be appreciated that owing to its density much of the detail is lost; nevertheless, sufficient is visible in the area

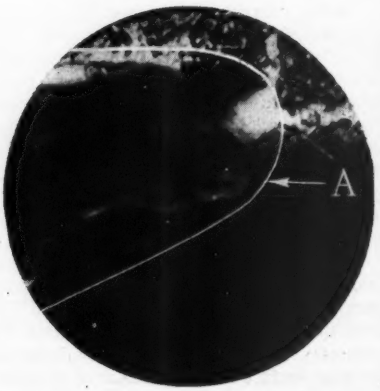

Fig. 303.—Section of oak-filled moulding showing dark particle in transverse direction. Mag. 500 diameters.

marked A to enable a number of thick-walled fibres to be distinguished. These will be seen to possess a small lumen and a very heavy wall thickening. The chief significance of this illustration, however, lies in the appearance presented by the dark substance in this area. It is seen as if to be issuing from the bores of the vessels in streams, which seem to spread out and cover the section. A little thought on the matter will show that in reality this cannot be so, as the whole mass from which the section was cut was solid, and it is equally certain that this apparent flowing could not have occurred after cutting. There is, therefore, only one conclusion at which we may arrive, this being that the dark substance has diffused through and interpenetrates the cellulose walls of the vessels.

We are now confronted with the problem as to how and why this occurs; unfortunately, there is no evidence offering an explanation, but in view of that presented by this micrological examination, it might be suggested that the tannin, and such lignin that happens to be present, takes part in the resin reaction in some way, but whether this occurs between the dry tannins and the resin, or whether the tannin is first leached out by the initial reaction water and then combines with the resin, is not clear. However, in view of the appearance it seems likely that the tannin is first leached out. Thus the final product would be of this diffuse nature.

If this condition actually exists, then in the dark particles we have units which are extremely well impregnated with a product which is of a different nature from that of the main resin mass, and presumably of a more brittle texture. This may be expected to lead to differing coefficients of expansion between the external resin and the internal resin tannin complex and also between this latter and the material of the walls of the vessels, added to which it must be remembered that lignin is also present to complicate matters, apart from pentosans, etc., to be found in this tissue.

These particles may be taken as being composed in general of the heavily thickened fibrous portion of the wood, and it is interesting to note that not all the fibre bundles exhibit the dark colour. In Fig. 304 we see one of these dark particles in longitudinal section, at a magnification of 500 diameters, from which it will be seen that only one portion of it exhibits the dark coloration. The remainder of this particle presents the characteristic appearance of the wood.

Fig. 304.—Section of oak-filled moulding showing dark particle in longitudinal direction. Mag. 500 diameters.

It is also interesting to note that in all cases where these dark particles occur, the colouring matter is seen to be diffused and gives rise to the curious effect of softening throughout outlines of the unit. This is in all probability due to diffusion of the material into the surrounding matrix. A clear space will be seen to the left of this particle, due to the formation of a bubble in the resin mass at this point. This bubble will be seen to be of appreciable size and was probably developed by the formation of a vapour pocket early in the curing stage, but it is chiefly of interest in that similar voids in somewhat similar locations are to be seen associated with these dark particles elsewhere in this section.

The cause of the origin and position of these voids, however, is not exactly clear.

(*Continued on page* 334)

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

B.P. 597,030. Application date: 17.5.44. Accepted: 16.1.48.

Improvements in and relating to Shaped Articles having a Molecularly Oriented Structure. To: The British Thomson-Houston Co., Ltd.

Manufacture of filaments suitable for filter cloth and textiles, by cold drawing a copolymer of acrylonitrile (40-80 per cent.) and diethyl itaconate.

B.P. 597,031. Application date: 6.6.44. Accepted: 16.1.48.

Improvements in or relating to the Manufacture of Polymeric Substances. H. M. Stanley, F. E. Salt and J. F. Williams. To: The Distillers Co., Ltd.

B.P. 597,077. Application date: 9.8.45. Convention date (U.S.A.): 15.8.44. Accepted: 16.1.48.

Improvements in or relating to Flame-resistant Regenerated Cellulose Sheets or Films and to Flame-resisting Treatment of Regenerated Cellulose Sheets or Films. To: British Cellophane, Ltd.

Rendering regenerated cellulose sheet or film flame-resistant by incorporating at least 20 per cent. of ammonium sulphamate or an alkali or alkaline earth metal salt of sulphamic acid, at least 10 per cent. of a hydroxylated softening agent (glycerol, ethylene glycol, etc.) and at least 0.5 per cent. of a formaldehyde-yielding material.

B.P. 597,083. Application date: 11.8.45. Accepted: 16.1.48.

Improvements relating to a Method of Coating Cementitious Surfaces with Self-hardening Resinous Compositions. F. G. Mottershaw and G. L. Griffin. To: Semtex, Ltd.

Coating of cementitious surfaces by first forming an acid-reacting film by treatment with an aqueous solution of a water soluble, film-forming material (polyvinyl alcohol, animal glue, gelatine or methyl cellulose) and an acid (oxalic or sulphuric acid) which will react with the alkaline constituents of the cement, forming a water-insoluble compound, drying of the surface, and applying thereafter to itself hardening acidic resin coating of the phenol-formaldehyde type.

B.P. 597,099. Application date: 12.6.45. Convention date (France): 25.11.38. Accepted: 19.1.48.

Improvements in or relating to the Manufacture of Water Soluble Condensation Products. To: Manufactures de Produits Chimiques Du Nord Etablissements Kuhlmann.

Condensation of methylol derivatives of phenol with alkali bisulphites in aqueous medium. The products so obtained are water soluble and may be used in tanning, in the textile industry, etc., also as fungicides.

B.P. 597,144. Application date: 18.9.45. Convention date (U.S.A.): 29.9.44. Accepted: 19.1.48.

Improvements in or relating to Synthetic Resinous Adhesive Compositions. To: Westinghouse Electric International Co.

Resinous binder for metallic laminations consisting of a resorcinol-formaldehyde resin mixture with polyvinyl acetate.

B.P. 597,168. Application date: 12.2.45. Accepted: 20.1.48.

Improvements in and relating to Adhesive Fabrics. A. P. Shaw.

Self-adhesive surgical bandage in which textile gauze has distributed over the surface, as an adherent layer, minute separate globules of polyisobutylene.

B.P. 597,178. Application date: 28.6.45. Convention date (U.S.A.): 1.7.44. Accepted: 20.1.48.

Improvements in and relating to Methods of Preparing Alkylchloropolysiloxanes. To: The British Thomson-Houston Co., Ltd.

B.P. 597,181. Application date: 20.7.45. Convention date (U.S.A.): 22.7.44. Accepted: 20.1.48.

Improvements in and relating to Pressure-sensitive Adhesives. To: Johnson and Johnson (Gt. Britain), Ltd.

Pressure-sensitive adhesive comprising an elastomeric base and a tackifying resin. The elastomeric base consists of a butadiene-styrene copolymer and a lesser proportion of polyisobutylene.

B.P. 597,191. Application date: 11.8.45. Accepted: 20.1.48.

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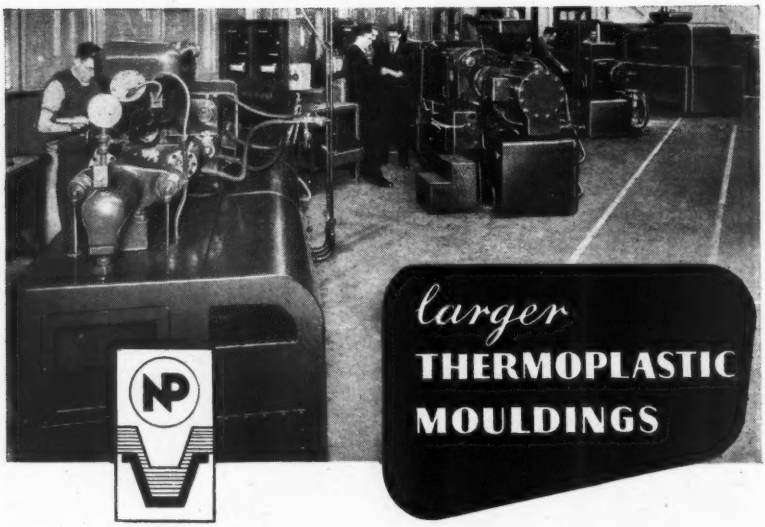

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Improvements relating to Urea-formaldehyde Syrups and their use in the Preparation of Cold Hardening Compositions. F. G. Mottershaw and G. J. L. Griffin. To: Senitex, Ltd.

Synthetic resin made by reacting formaldehyde, furfuryl alcohol, urea and thiourea.

B.P. 597,214. Application date: 14.4.44. Convention date (U.S.A.): 1.5.43. Accepted: 21.1.48.

Improvements in or relating to Polymerization Method and Apparatus. To: International Polaroid Corp.

Method of polymerization by which the material to be polymerized is confined in a fluid-tight deformable container and maintained at elevated temperature; different portions of the container are successively compressed to circulate and mix the material.

B.P. 597,218. Application date: 18.8.44. Convention date (U.S.A.): 7.11.41. Accepted: 21.1.48.

Improvements in or relating to Resinous Electrically Insulating Compositions and to Electrical Apparatus impregnated therewith. To: Westinghouse Electric International Co.

B.P. 597,223. Application date: 17.11.44. Convention date (U.S.A.): 12.7.41. Accepted: 21.1.48.

Process for the Production of Ethyl Benzene. To: Standard Oil Development Co.

Production of ethyl benzene from benzene and ethylene in the presence of aluminium chloride and hydrogen chloride as promoter.

B.P. 597,241. Application date: 20.4.45. Accepted: 21.1.48.

Improvements in Sewing Textile Materials. E. L. Greenwood and A. S. Bell. To: British Celanese, Ltd.

Stitching of textile fabrics by forming stitches with a thread comprising both fibres of a thermoplastic material (cellulose acetate) and fibres of a non-thermoplastic material (cellulose) and subsequently heat-treating the stitched textile in order to set the stitch (and the thermoplastic) to render unravelling difficult.

B.P. 597,242. Application date: 27.4.45. Accepted: 21.1.48.

Improvements relating to the Packaging of Tooth-brushes or other articles. A Communication of the Celon Company.

B.P. 597,253. Application date: 27.6.45. Accepted: 21.1.48.

Production of Poly-amino Compounds. G. J. N. Dewitt and M. B. Green. To: British Celanese, Ltd.

Refers to the production triamines.

B.P. 597,270. Application date: 12.4.45. Convention date (France): 28.3.41. Accepted: 22.1.48.

Process for the Recovery of Waste Imitation Leather Products. To: Salpa Francaise.

Method of recovering artificial leather waste containing polyvinyl or other thermoplastic resins by passing the waste material several times through heated grinding rolls and subsequent colandering.

B.P. 597,285. Application date: 13.8.45. Convention date (U.S.A.): 11.8.44. Accepted: 22.1.48.

Process for the Preparation of Synthetic Resin-Modified N-Alkoxymethyl Polyamide Compositions. To: E. I. Du Pont de Nemours and Co.

B.P. 597,295. Application date: 13.8.45. Convention date (U.S.A.): 12.8.44. Accepted: 22.1.48.

Improvements in the Production of Organic Acid Esters of Cellulose. To: British Celanese, Ltd.

Refers to a ripening process for cellulose acetate by injecting hot steam into the primary ester solution.

B.P. 597,326. Application date: 27.11.41. Accepted: 23.1.48.

Treatment of Polymeric Materials. D. A. Harper and R. J. W. Reynolds. To: Imperial Chemical Industries, Ltd.

Modification of the properties of synthetic linear polyamides by uniformly mixing with them a formaldehyde liberating substance and subsequent heating whilst or after form-the mix into shape.

B.P. 597,327. Application date: 12.5.44. Convention date (U.S.A.): 13.5.43. Accepted: 23.1.48.

Improvements in and relating to Pressure Sensitive Adhesive Tapes or Sheets made with a Woven Glass Fabric Backing. To: Johnson and Johnson (Gt. Britain), Ltd.

Manufacture of pressure sensitive adhesive sheets or tapes, having a woven glass fabric backing. The fabric is slit with a cutting tool and a binder coating (cellulose ether or ester or polyvinyl ester) is applied to at least one surface of the fabric prior to slitting

B.P. 597,343. Application date: 24.7.45. Convention date (France) 20.8.43. Accepted: 23.1.48.

Articles for Decorative Use and a Process

for Manufacturing them. To: Société des Usines Chimiques Rhône-Poulenc.

B.P. 597,361. Application date: 17.8.45. Accepted: 23.1.48.

Improvements in and relating to Curved Material comprising a laminated Skin and a light-weight Core. B. Jablonsky

Curved composite material comprising a cellular body of expanded or foamed rubber, cemented to a laminated skin; the cellular body is curved by a pressing process before it is united with the laminated skin.

B.P. 597,366. Application date: 17.8.45. Accepted: 23.1.48.

Preparation of Chlorofluorosilane. J. W. Hill, R. V. Lindsey, Jr., and R. H. Wiley. To: E. I. Du Pont de Nemours and Co.

Refers to the preparation of dichloro difluorosilane.

B.P. 597,367. Application date: 17.8.45. Convention date (U.S.A.): 19.8.44. Accepted: 23.1.48.

Preparation of Organosilicon Halides. To: Imperial Chemical Industries, Ltd.

B.P. 597,368. Application date: 17.8.45. Convention date (U.S.A.): 9.8.44. Accepted: 23.1.48.

Improved Polymers and Copolymers of Acrylonitrile. To: Imperial Chemical Industries, Ltd.

Refers to the copolymerization of acrylic nitrile and monomeric dithioglycidol.

B.P. 597,372. Application date: 17.8.45. Convention date (U.S.A.): 23.8.44. Accepted: 23.1.48.

Improvements in or relating to Process and Apparatus for the Treatment of Thermoplastic Sheet Material. To: Bakelite, Ltd.

Process and apparatus for the heat treatment of thermoplastic sheets or films. The heat treatment has the effect of removing or reducing internal stresses, furthermore it imparts a smooth, glossy surface or an embossed surface to the stress-relieved plastic.

B.P. 597,403. Application date: 22.12.44. Convention date (U.S.A.): 4.3.44. Accepted: 26.1.48.

Dehydration of Liquids by Electrostatic Heating. V. W. Sherman. To: Standard Telephones and Cables, Ltd.

B.P. 597,404. Application date: 28.12.44. Convention dates (Switzerland): 24.12.43 and 10.11.44. Accepted: 26.1.48.

Manufacture of Artificial Fibres from Casein, Carbamide Compounds and Formaldehyde. To: Society of Chemical Industry (Basle).

B.P. 597,417. Application date: 30.5.45. Convention date (U.S.A.): 24.10.44. Accepted: 26.1.48.

Film Forming Composition. To: Wingfoot Corporation.

Film composition resistant to water vapour, consisting of a copolymer of vinyl chloride and 40-80 per cent. of vinylidene chloride in an intimate mixture with other vinyl chloride polymers.

B.P. 597,428. Application date: 1.8.45. Convention date (U.S.A.): 1.8.44. Accepted: 26.1.48.

Improvements in and relating to Method of Packaging and Machine therefor. L. L. Salfisberg.

B.P. 597,435. Application date: 17.8.45. Accepted: 26.1.48.

Printed Fabrics and Methods of Producing same. To: Cranston Print Works Co.

Method of producing effects on textile fabrics by printing a pattern on the cloth with a printing paste containing a polymerizible melamine formaldehyde resin, drying the printed cloth, so that the resin will not adhere to the rolls during the following polishing operation, polymerizing the resin on the heated polishing rollers, washing and drying the cloth, thereby restoring a non-glazed surface to the imprinted area. A pliable printed cloth is obtained, which has a permanent pattern resulting from the contrast between glazed and non-glazed areas.

B.P. 597,445. Application date: 5.7.45. (Divided out of B.P. 597,057.) Accepted: 26.1.48.

Improvements in or relating to the Manufacture of Capsules. E. G. Fisher.

Refers to the manufacture of capsules for medical treatment, enclosed in a gelatine envelope.

B.P. 597,497. Application date: 22.8.45. Accepted: 27.1.48.

Improvements in or relating to the Production of Insolubilized Protein Artificial Filamentary Products. R. H. K. Thomson. To: Imperial Chemical Industries, Ltd.

B.P. 597,498. Application date: 22.8.45. Accepted: 27.1.48.

Improvements in the Production of Laminated Sheets. J. E. Nithingale. To: Imperial Chemical Industries. Ltd.

Production of a sheet consisting of two or three layers of solid polymerization products united by subjecting a solution of poly-

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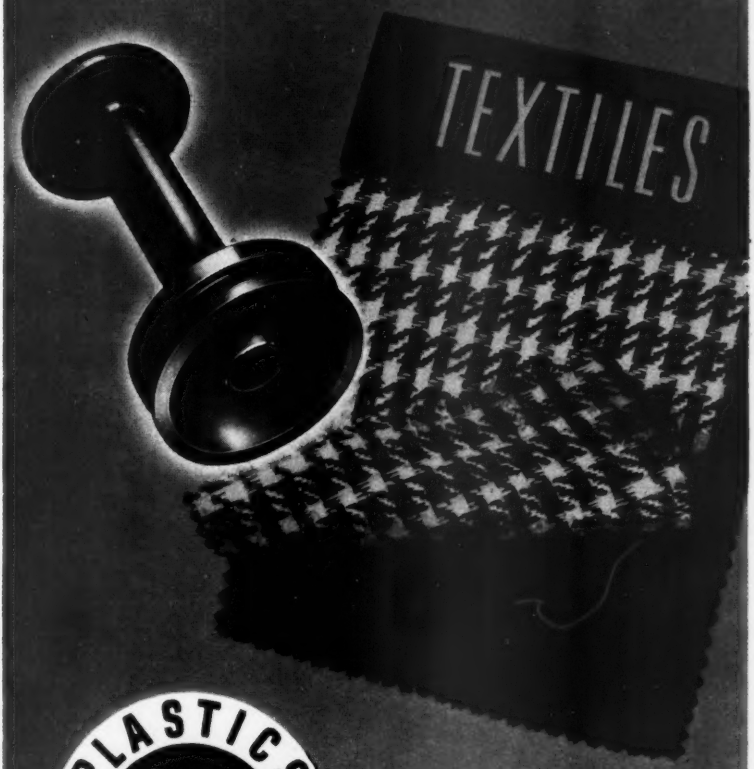

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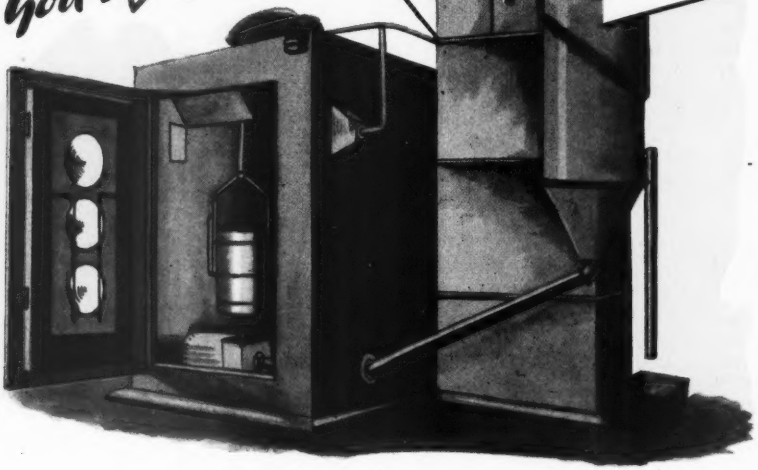

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methyl methacrylate in methyl methacrylate to polymerizing conditions in a flat chamber, the flat side walls of which are capable of relative movement. After polymerization has taken place one of the side walls is moved to create a gap which is filled with the above-mentioned liquid and polymerization restarted, thus forming a laminate.

B.P. 597,512. Application date: 25.9.44. (Patent of addition to B.P. 513,866.) Accepted: 28.1.48.

Improvements in Production of Moulding Powders and Plastic Masses. J. R. Alexander and F. Hausmann. To: William Walker and Sons, Ltd.

Urea-formaldehyde compositions prepared by adding to the aqueous solution of a partial condensate an inorganic lactate, drying of the mix and subsequent grinding to the appropriate fineness. Freedom from cracking and crazing are claimed for mouldings made from such improved moulding powders.

B.P. 597,514. Application date: 6.12.44. Convention date (U.S.A.): 8.12.43. Accepted: 28.1.48.

Potentially Adhesive Filaments and Yarns, Fabrics, Felts and similar Textile Materials made therewith. To: Sylvania Industrial Corporation.

B.P. 597,556. Application date: 22.8.45. Convention date (U.S.A.): 1.5.45. Accepted: 28.1.48.

Modified Butadiene-Styrene Copolymers. To: Wingfoot Corporation.

Refers to a synthetic rubber composition containing 60-85 per cent. of cyclized natural rubber and 40-15 per cent. of a butadiene-styrene copolymer.

B.P. 597,590. Application date: 11.7.45. Accepted: 29.1.48.

Improvements in or relating to the Manufacture of Resinous Condensation Products. E. A. Bevan and R. S. Robinson. To: Beck, Koller and Co. (England), Ltd.

Manufacture of resinous condensation products by reacting maleic acid or substitutes thereof with ammonia until resinification occurs. Alternatively resins are produced by heating non-resinous ammonium salts or amides of maleic acid or its substitutes.

B.P. 597,643. Application date: 15.11.44. Accepted: 30.1.48.

An Improved Process for the Polymerization of Olefinic Hydrocarbons. To: Standard Oil Development Co.

Low temperature polymerization of olefinic hydrocarbons in the presence of a metal halide catalyst; both reactant and catalyst are contacted in the presence of a diluent (methyl chloride) which is being recycled.

B.P. 597,666. Application date: 31.7.45. Accepted: 30.1.48.

A Method of Joining Thermoplastic Materials by Electro-magnetic Induction. A. Benn and H. G. Allen. To: Ministry of Supply.

H.F. welding of polythene. Owing to the low power factor of polythene, dielectric heating is not possible. A mild steel washer is inserted in a cavity between the two parts to be welded and the whole assembly placed in an energizing coil fed with high-frequency alternating currents. The washer heats up and fuses the surrounding polythene, thus effecting a weld.

B.P. 597,677. Application date: 31.8.45. Convention date: (U.S.A.) 1.9.44, 18.10.44. Accepted: 31.1.48.

Improvements in or relating to the Production and Purification of Cellulose Esters. To: British Celanese, Ltd.

Improving the moulding properties of cellulose esters by subjecting the ester to extraction with an aqueous lower aliphatic alcohol (methyl, ethyl or isopropyl alcohol).

B.P. 597,704 Application date: 21.8.45. (Patent of addition to B.P. 563,287). Accepted: 2.2.48.

Improvements in Cellulose Derivative Materials. W. J. Simpson and D. Finlayson. To: British Celanese, Ltd.

Cellulose acetate composition stabilized to withstand the destruction of ultra-violet light by adding to the cellulose acetate mix up to 15 per cent. of resorcinol disalicylate.

B.P. 597,712. Application date: 24.8.45. Convention date: (U.S.A.) 31.8.44. Accepted: 2.2.48.

Improvements in and relating to Synthetic Resinous Condensation Products. To: The British Thomson-Houston Co., Ltd.

Resinous condensation products prepared by heating together under alkaline conditions an aldehyde and a mixture of isomers of amino-para hydroxyanilino triazoles.

B.P. 597,726. Application date: 24.8.45. Convention date: (U.S.A.) 30.8.44. Accepted: 2.2.48.

A Process for the Manufacture of Granular Amine-Aldehye Moulding Composition. L. Smidth.

MICROSCOPIC EXAMINATION OF PLASTIC MATERIALS

(*Continued from page 329*)

It is probable that the reaction in the vicinity of the dark particles gives rise to a higher proportion of vaporous or liquid products than is normally the case in the early stages of curing. That this is probably the case will be appreciated when it is seen that the illustration obviously indicates that some considerable pressure existed in the cavity, as the surrounding particles have to be distorted to fit around the shape of the bubble. The doubt in this suggestion lies in the possibility of the pressure being due to that existing in the comparatively fluid mass surrounding the void. From what has been said it will be seen that, in general, these dark particles, while being interesting from the point of view of their structural and physical characteristics, are nevertheless an undesirable component in the filler, but as they are part of the structure of the wood it is difficult to see how this problem is to be overcome.

(*To be continued*)

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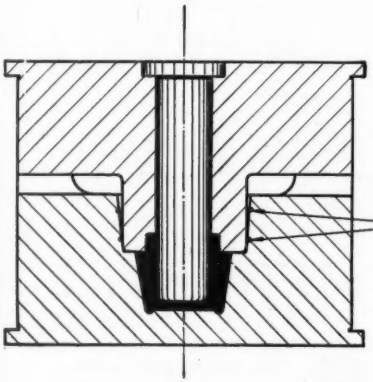
Leaves from a Moulder's Notebook

This is the eighteenth in a series of notes by the B.I.P. Development Department on the problems of the moulder and designer. Nos. 1—12 in this series are now available in booklet form and B.I.P. will be pleased to send a copy of this and subsequent notes on request. Comments and enquiries are welcome.

Flash *(continued)*

A highly polished mould surface will often ensure that flash obtains no hold on it, but the very gradual building up of the semi-cured spew on parts such as the shank of a punch will quickly destroy the polish; in a short time a mould which at first gives no signs of 'flash sticking' will so lose the polish on its punches that a secure anchorage for flash is provided and from that time onwards flash removal becomes a time-consuming process.



A safeguard lies in incorporating grooves or vents in the die at strategic points to hold the flash skirt in the bottom tool, for instance in the cavity of a mould as that illustrated. If the grooves are correctly proportioned the removal of the flash by compressed air will take a few seconds only. The grooves can be cut by grinding and determined by trial and error.

In the case of one mould, on the average twenty seconds per lift were being expended in removing flash from the punches, which although originally polished and plated had had their finish impaired by the building up of semi-cured escaping material; scrap resulted where the moulder failed to remove the flash sticking to the punch.

The introduction of grooves in the inner wall of the cavity of each die provided a solution, the twenty seconds per lift being saved and scrap being avoided.

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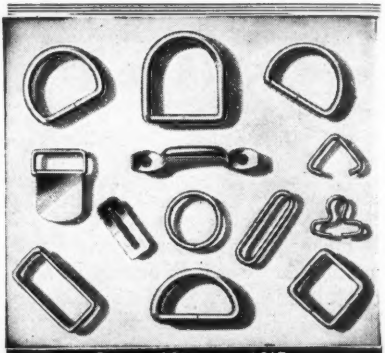

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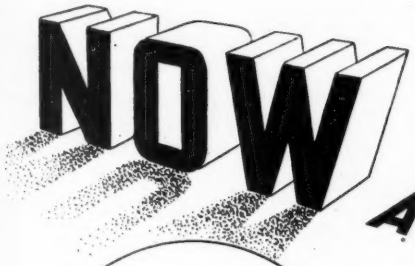

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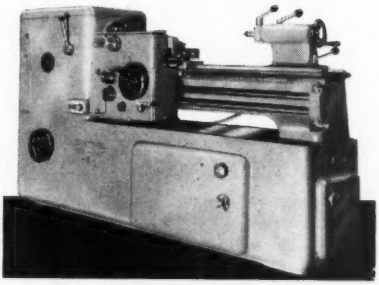

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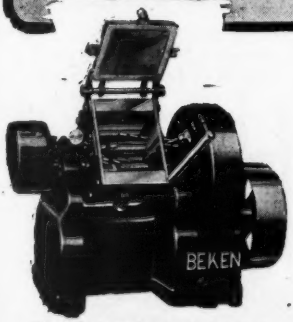

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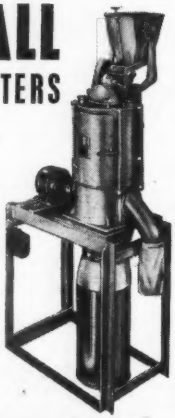

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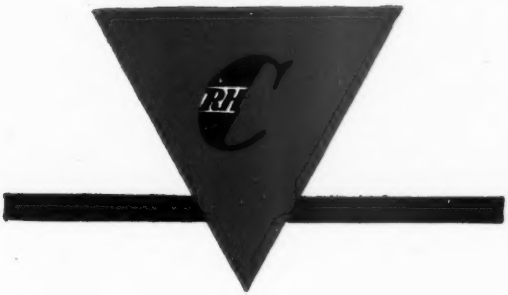

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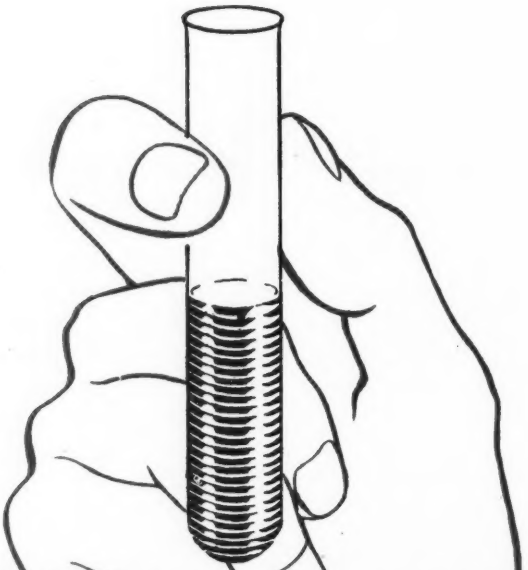

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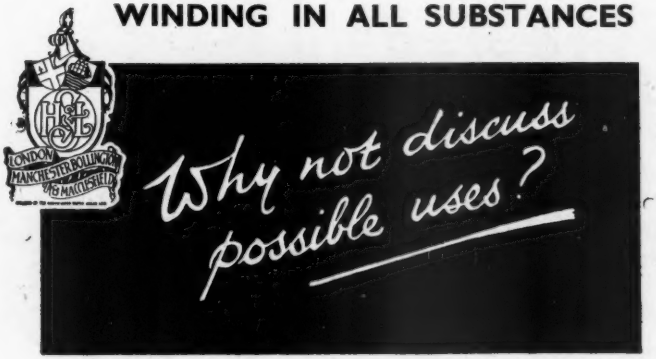

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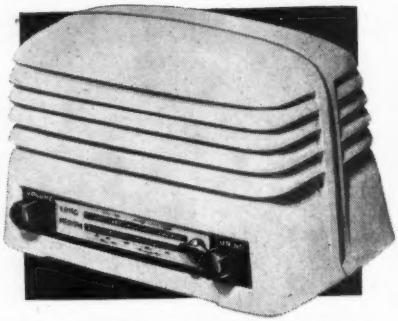

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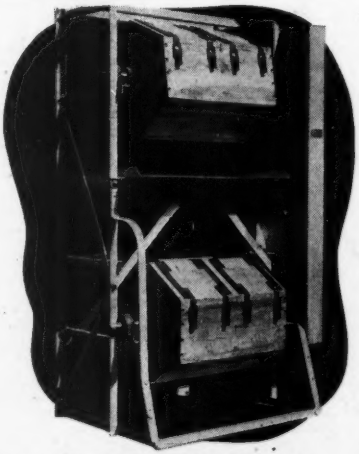

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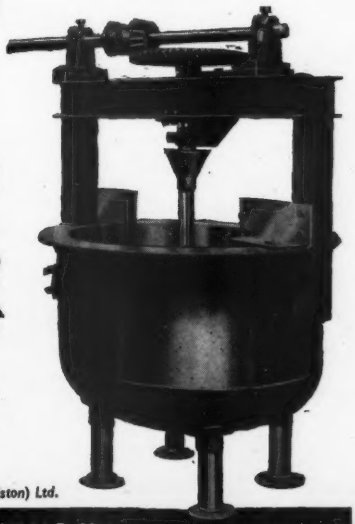

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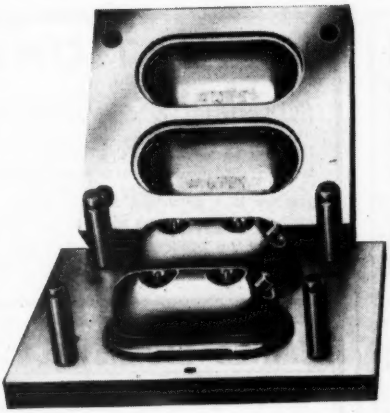

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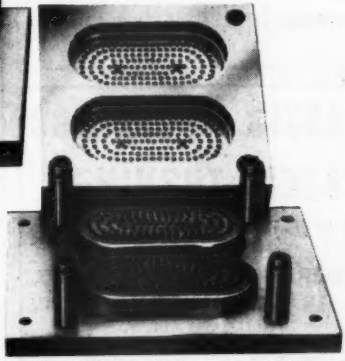

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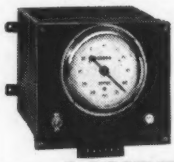

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Phenol formaldehyde, black and brown, guaranteed quality, 1s. 2d., immediate delivery. John F. Mann, Ltd., 143 Cannon Street, London, E.C.4. Phone, Man 1270. 133-41

Raw Material Available and Wanted (contd.)

D. H. Ridout and Son, Ltd. Reg. Office, 12 Stedman Road, Southbourne, Bournemouth (phone 505), offer:—New Perspex sheets, 48 ins. by 36 ins. by 1-16 in. to 3-16 in., from 45s. per sheet. Other sizes pro rata. Scrap crystal and amber Perspex from 1s. 3d. to 2s. per lb., according to gauge and quantity required. Acetate and celluloid transparent sheeting from 1s. 6d. per lb. Coloured transparent and opaque celluloid and acetate sheeting from .007 in. to .120 in., from 3s. 9d. per lb. Crystal acetate, 2, 3, 4, 5 and 6 mm., from 5s. 6d. per lb. Full-size sheets. Large stock of various plastic materials suitable for lamp shade, toy makers and upholsterers, etc. Samples and stock list on request. 133-42

CELLULOSE ACETATE SHEETS

Size 15 ins. by 12 ins., 13 sheets to a pound, 3s. 6d. per lb. For orders of 1 cwt. or over, 3s. 3d. per lb. Carriage extra.

Obtainable from:—

GRANGE PRODUCTS,
269-271 FRATTON ROAD,
PORTSMOUTH.
Portsmouth 73982. 133-33

Perspex. For sale, about 5 tons clean, clear scrap and small offcuts. John Castle and Co., Ltd., 18a Newport Street, Lambeth, S.E.11. 133-46

P.V.C. For sale, clean sheeting cuttings and cable strippings. John Castle and Co., Ltd., 18a Newport Street, Lambeth, S.E.11. 133-45

Wanted, thermoplastic moulding powders and moulding scraps, all kinds. Offers and samples to Alfa Plastics, Ltd., 20-21 St. Dunstan's Hill, E.C.3. 133-47

Regular quantities of cellulose acetate scrap, solid shaving and dust available. Write, stating price offered, to Box 4297, care of "Plastics." 133-50

Polythene powder (white) for disposal, well below maker's price, sample sent upon request. Box 4272, care of "Plastics." 135-246

Always large stocks of
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rods, tubes and sheets.
PERSPEX
sheets up to 1-in. thick.
CELLULOSE ACETATE.
S. Rosenfeld,
93 Aldersgate Street, E.C.1.
Phone, Clerkenwell 4686. 138-250

An entirely new embossed sheeting, ideal for upholstery and fancy leather goods, unbacked, extremely strong, tough and pliable, excellent graining, antique, morocco, calf, pigskin, etc., all standard colours, 48-in. width. Almex, Ltd., Exchange Buildings, Stephenson Place, Birmingham, 2. Midland 0682. Cuprex, Ltd., 120 Moorgate, London, E.C.2. Metro 9641. zzz-223

A lighting fittings manufacturer seeks an alternative plastic material to those more in current use. Forward details to Box 4298, care of "Plastics." 134-255

I.C.I "Perspex" acrylic sheeting. Stockists offer all thicknesses and colours, substantial rebate for coloured materials in large quantities. Also I.C.I. crinothene sheeting for lampshades, upholstery, etc. Also polythene powder for sale in opaque colours. Regular supplies. And all other injection moulding powders. Almex, Ltd., 78 Exchange Buildings, Birmingham, 2 (Midland 0682), and Cuprex, Ltd., 120 Moorgate, London, E.C.2 (Metro 9641). zzz-220

Ebonite and bakelite always in stock. Phone, Archway 3654. A. E. Goodeve, Ltd., 188a Seven Sisters Road, London, N.7. 139-4965

Metal powders and oxides. Quotations and samples on application. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-410

Scrap. Why not let a well-established firm quote you for cellulose acetate, polystyrene, P.V.C. cuttings and other thermoplastic off-cuts and scrap? Having best use for these materials, highest prices can be paid. Quotations on receipt of representative samples to M. H. Grist (Plastics), Ltd., 82-84 Brighton Road, Surbiton, Surrey. Phone, Elmbridge 4214. zzz-457

Wanted, plastic waste and plastic piece goods. Send particulars, stating quantity and price. Box 2382, care of "Plastics." zzz-468

Raw Material Available and Wanted (contd.)

Polythene cable strippings, moulding, scrap and foil urgently required, state amount available and send small sample. Box 3186, care of "Plastics." zzz-217

Buna-plast, a blending of synthetic rubber and P.V.C., specially processed for manufacturing leather substitute; this material is far superior to plasticized P.V.C., inquiries welcomed. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-216

P.V.C. calendering compound in a range of opaque colours. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-215

Polystyrene moulding scrap urgently required, state amount available and send small sample. Box 3185, care of "Plastics." zzz-214

Regular supplies of imported celluloid in sheets, tubes and rods. H. J. Alter, 51 Seymour Street, W.1. Phone, Paddington 3137. zzz-221

Perspex, clear, in sheets 4 ft. by 3 ft, 3/16-in. thick, large quantity available for immediate delivery. Your inquiries, and keen quotation and sample, to A. Drury, Heathfield, Sussex. 133-6

Uren formaldehyde powders and granules, snow white, pink, red, orange, yellow, royal blue, medium blue, natural (opal) and other colours, from America. Write, N. Bucknall, Manufacturers' Agent, 1-3 St. Paul's Churchyard, E.C.4. Phone, Central 5765. 133-7

Tufnol sheeting (Whale brand), 62 sheets, 4 ft. by 4 ft. by ⅝ in. Sale against best offer. Box 4264, care of "Plastics." 133-8

Polystyrene moulding powder, finest virgin material, for disposal. Delivery immediate ex-stock, 4½ tons, colours being clear, white, green, red, black royal blue. Keen price to clear. Box 4263, care of "Plastics." 133-9

Thermoplastic scrap urgently required, in particular polystyrene and polythene, also redundant moulding powder stocks. Send samples and price required to Box 4268, care of "Plastics." 133-13

We have all types of thermoplastic scrap, reconditioned moulding powders and virgin moulding powders available, and shall be pleased to receive your inquiries for samples and quotations. Please state exact requirements to Box 4267, care of "Plastics." 133-12

Cellulose acetate injection, first quality virgin material in several colours, for sale, also quantity of Crinothene in standard rolls, pastel shades. Box 4265, care of "Plastics." 133-16

For sale, 4,500 lb. alkathene powder (new), 1,130 lb. jointing material (unused), 28,340 reinforcing wires for spectacle sides, 360 gross spectacle fronts and 61 gross moulded sides. For further particulars write, Milex-Star Engineering Co., Louth Road, Grimsby. 133-1

Perspex, clear and coloured, flat sheets, 54 ins. by 48 ins., 48 ins. by 36 ins., smaller sizes cut. Perspex corrugated roof lights, all sizes. Flat and corrugated aluminium and alloy sheets, 8 ft. by 4 ft., 6 ft. by 3 ft., 16-22 gauge. Henry Moat and Son, Ltd., Atom Works, Newcastle. 133-2

For disposal:—
3 sheets Perspex, black, 48 by 36 by ¼ thickness.
17 sheets Perspex, green, 48 by 18 by ⅛ thickness.
30 sheets Perspex, turquoise, 48 by 18 by ⅛ thickness.
13 sheets Perspex, turquoise, 48 by 18 by 3/16 thickness.
5 sheets Perspex, turquoise, 48 by 24 by ⅛ thickness.
30 sheets Perspex, yellow, 48 by 19 by ⅛ thickness.
5 sheets Perspex, yellow, 36 by 24 by ⅛ thickness.
At I.C.I. prices or near offer.
Also a quantity of surplus of clear cuts at 2s. 9d. lb. and a quantity of Catalin rod in various sizes and colours at current Catalin prices.
Inquiries to the Hill Irving Plastic Co., Ltd., of 4 Wakeman Road, Willesden, London, N.W.10. Phone, Ladbroke 3688. 133-4

SITUATIONS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50, inclusive, or a woman between the ages of 18 and 40, inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1947, or the vacancy is for employment excepted from the provisions of that Order.

Laboratory assistant required for research work dealing with new plastic material developments; applicants should not exceed 20 years and should have intermediate B.Sc., experience in plastics an advantage but not essential. British Nationality, good references. Please write Box 3214, care of "Plastics." 134-3040

Laboratory assistant required for research work on new plastic material developments; applicants should not exceed 18 and must be of British Nationality, experience in plastics an advantage, but not essential, good references. Please send particulars of education, etc., to Box 3215, care of "Plastics." 134-3041

Situations Vacant (contd.)

Chemist, physical chemist or physicist, required for research laboratory engaged in new plastic material development; applicants should have B.Sc., be of Brit.sh Nationality and not above 25 years, good references essential, salary according to age, qualifications and experience. Please apply Box 3213, care of "Plastics." 134-3039

Graduate organic chemist age 25-35 years, required in Yorkshire, preferably with practical experience in the production of synthetic resins and similar materials. Knowledge of physical chemistry an advantage but not essential. Salary according to age and qualifications, superannuation scheme in operation. Replies to Box 3825, care of "Plastics." 133-6441

Bakelite Limited require a technical assistant to work in the Darlington area on production problems, preferably with chemical engineering qualifications; a chemist with engineering experience or engineer with chemical knowledge will be considered. The nature of the work will be to investigate alternative manufacturing methods for plastic materials leading to improved plant design and arrangements. Reply to: Bakelite Limited, Tyseley, Birmingham, giving details of age, experience, qualifications and salary required. 133-6436

Technical representative (plastics) required, resident in Manchester, for North of England, Midlands and Scotland, aged about 25, graduate preferred but candidate with knowledge of chemistry and engineering up to Inter.B.Sc. standard would be acceptable, interview can be arranged in London or Manchester. Write initially, giving full particulars (confidential) and quoting reference No. 1433, to the Personnel Officer, May and Baker, Ltd., Dagenham, Essex. 133-3

Plastics. Qualified and experienced chemist required as works superintendent in new factory, South Wales, preference to applicants conversant modern extrusion technique with wide knowledge latest PVC compounds, polythene, polystyrene, etc. Write fully, detailing experience, qualifications, age and salary required, to Managing Director, Box D.950, c/o Streets, 110 Old Broad Street, E.C.2. 133-5

Chemical engineer required, 25-30 years of age, preferably single, after approximately one year's training (with pay) to go to Australia to act as technical salesman, permanent position assured for the right man, starting salary in Australia about £700 per annum. Reply to Box 4258, care of "Plastics." 133-19

Required by a large electrical firm in the Midlands, an engineer experienced in insulation problems in heavy electrical engineering and who is interested in research, preference given to engineers with an Honours degree. Apply quoting Ref. 106 to Box 4257, care of "Plastics." 133-20

Experienced sales representative required with technical knowledge of thermo-plastic and thermo-setting materials. Box 4254, care of "Plastics." 133-23

Chemist required by general rubber goods manufacturers in Manchester area for development work on plastics and rubber. Reply with details of experience, qualifications and salary required. Box 4251, care of "Plastics." 133-25

Qualified engineer to design and be responsible for the production of jig and machine tools in order to improve efficiency in an established quantity production factory. Experience of plastic moulding an advantage, fine prospects. Reply, with full details and salary required, to Box 4270, care of "Plastics." 133-29

Assistant works manager required by progressive company. Must be fully experienced in compression moulding technique, general presswork, assembly of electrical accessories. Practical experience in the above, together with organizing mass-production of most up-to-dates lines is essential. State fullest details of past experience in chronological order and salary required. Box 4021, care of "Plastics." 133-x93

Laboratory assistant required. Youth interested in chemistry and physics. London area. Write full details to Box 295, Frost-Smith Advertising, 64 Finsbury Pavement, London, E.C.2. 133-34

Ashdowns, Ltd., St. Helens, have the following vacancies for which applications are invited:—

(a) Technical representatives for various areas. Applicants must have some knowledge of plastic mouldings and be able to read engineering drawings. The position carries a salary but no commission.

(b) Technical assistant for development work on synthetic resin laminates. Age under 30. A graduate in chemical engineering would be preferred, but candidates possessing Higher National Certificate in Engineering or Chemistry and Physics will be considered.

(c) Technical assistant for development work on compression, injection and extrusion moulding of plastic materials. Practical experience essential and theoretical qualifications desirable.

Applicants for any of the above vacancies to write stating age and full particulars of experience and qualifications to the Secretary, Ashdowns, Ltd., Eccleston Works, St. Helens, Lancs. 133-35

Situations Vacant (conts.)

Plastics, sales representative for Midlands with knowledge of injection and compression moulding. Write, giving full details of experience, age and salary, to Box 4253, care of "Plastics." 133-24

A senior chemist is required by British Resin Products, Ltd., with several years' industrial research experience, preferably but not essentially in Plastics. Apply, Director of Research, 21 St. James's Square, London. 133-36

Chemist or Technician with experience in the paint and varnish trade required for immediate employment in the Development Laboratory of British Resin Products, Ltd. Apply Director of Research, 21 St. James's Square, London. 133-37

Foreman with extensive experience in injection moulding and finishing operations for our new factory required immediately. Apply, giving fullest particulars, Commercial Plastics, Ltd., Wallsend-on-Tyne. 134-251

Traveller wanted for London and Home Counties. Experience in selling proprietary products in plastics and a knowledge of acquiring trade moulding work essential. Alfa Plastics, Ltd., 20-21 St. Dunstan's Hill, E.C.3. 133-49

Chemist, organic, preferably hon. degree, required by large firm to take charge and develop laboratory section dealing with testing plastics materials and paints. Also be expected to carry out research on new plastic and paint applications in connection with production components. State age, qualifications, experience. Wilmot Breeden, Ltd., Camden Street, Birmingham. 138-40

SITUATIONS WANTED

Building and allied trades. House builder, with sales and sales management experience of various specialized products, wants the job of developing sales to building and allied trades. Box 4140, care of "Plastics." 133-x549

High Executive, company director (34), University graduate, used to positions of the greatest responsibility in the manufacture of plastics, raw material and semi-manufactured goods, considerable technical knowledge and production experience, wide connections in the trade, widely travelled, fully able to organize buying, manufacture and selling or to develop new projects, now free; seeking opportunity at home or overseas, giving full scope and yielding commensurate income; no capital available. Box 3942, care of "Plastics." 133-x9815

Plastics Technician at present in charge of mould design, tool room and moulding shop; apprenticeship as tool maker, with wide experience as such, thoroughly experienced designer of all types of compression and injection moulds with first-rate knowledge of moulding technique, having worked for some well-known firms; seeks similar position. Box 4274, care of "Plastics." 133-2[illegible]

Energetic Technical Manager of well-known London plastics company, moulding compounds, raw plastics, development, finished goods, sales experience, good contacts in the industry, desires change; would consider technical representation and consultation. Box 4255, care of "Plastics." 133-22

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Plastic cement for use with Perspex Acrylic sheets. Grade 1, available in large or small quantities, clear and coloured. Trade inquiries from Evolite Plastics, Ltd., 325 Latimer Road, London, W.10. Phone, Lad 1879. 1138-04011

Engraved name plates, scales dials, etc., supplied. Tickets and Co., Box 2, Silver Street, Leicester. 141-5699

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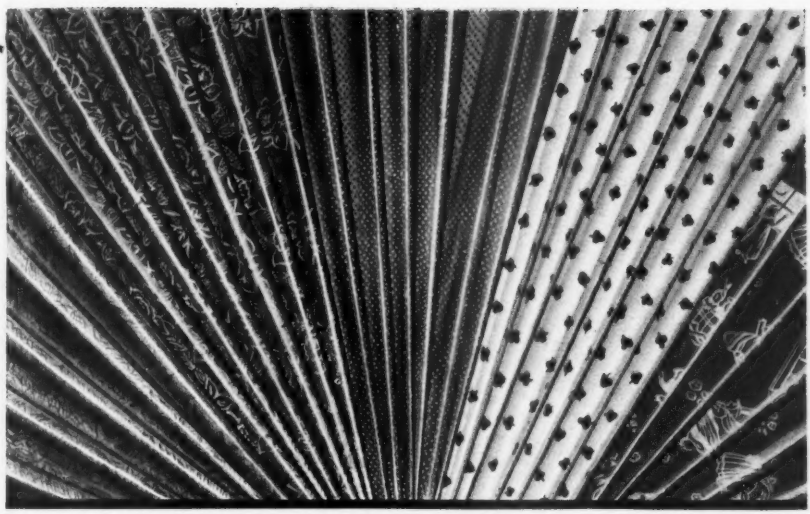

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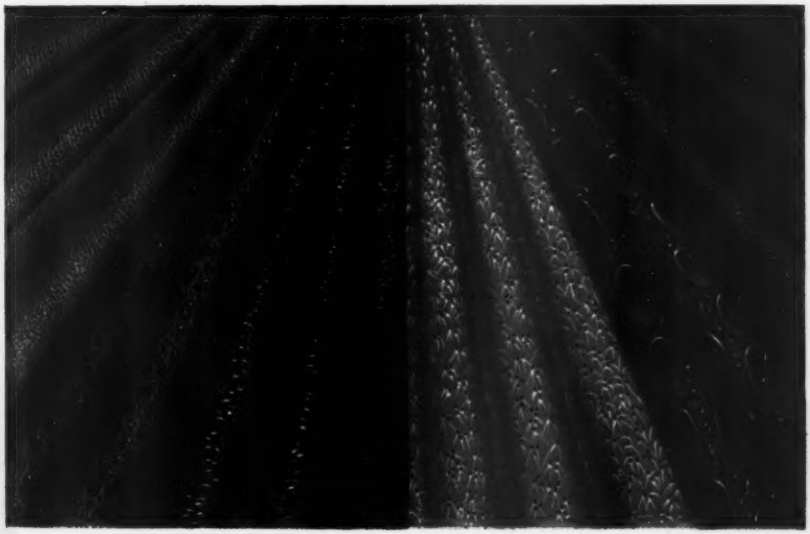

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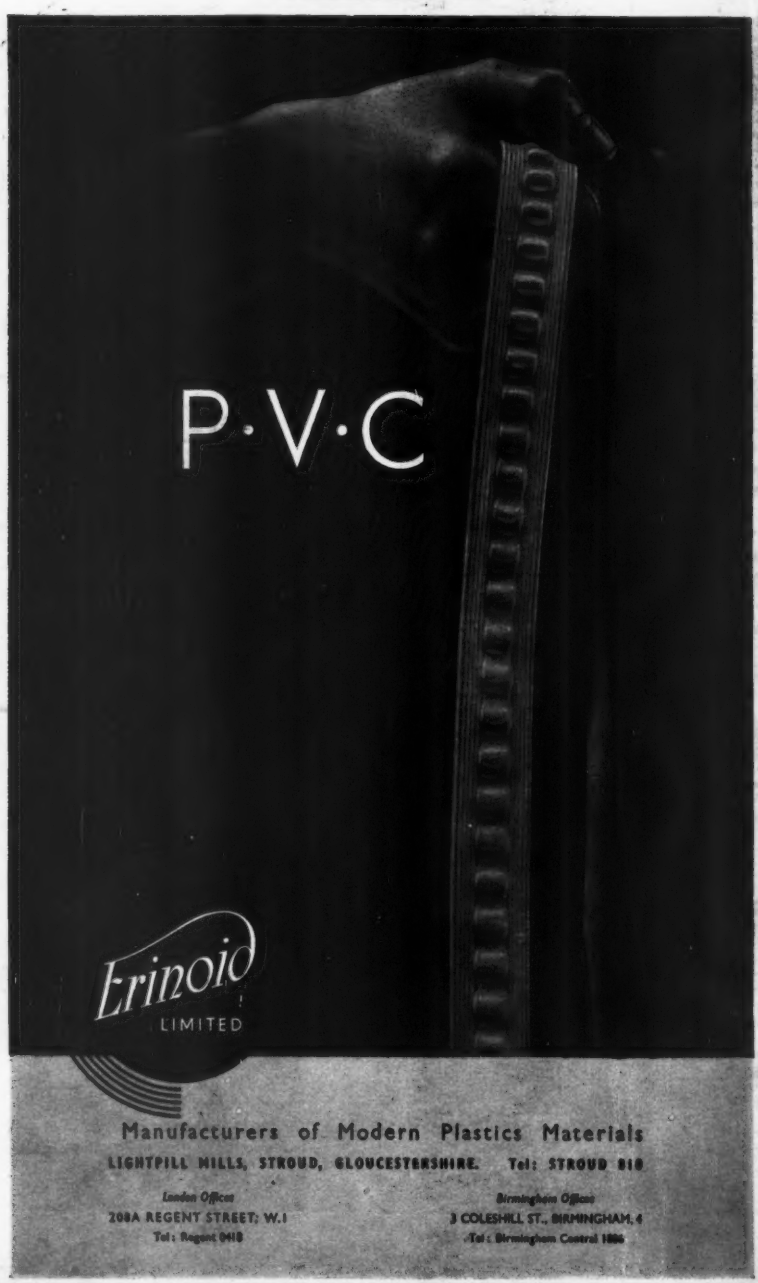

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